PB 131891—T14

CENTRAL INTELLIGENCE AGENCY

SCIENTIFIC

INFORMATION REPORT

23 January 1959

Distributed Only By

U.S. DEPARTMENT OF COMMERCE

OFFICE OF TECHNICAL SERVICES

WASHINGTON 25, D.C.

Issued Semi-monthly.   Price: Per year $28.00; Single issue $2.75.

PLEASE NOTE

This report presents unevaluated information extracted from recently received publications of the USSR, Eastern Europe, and China. The information selected is intended to indicate current scientific developments and activities in the USSR, in the Sino-Soviet Orbit countries, and in Yugoslavia, and is disseminated as an aid to United States Government research.

SCIENTIFIC INFORMATION REPORT

Table of Contents

NOTE: Items in this report are numbered consecutively.

I. ASTRONOMY

1. Accuracy of Quartz Clocks

"Investigation of Movement of Quartz Clocks KKh1, KKh2, and KKh3," by V. I. Turenko, Uch. zap. kharkovsk. un-t. 1957, 86, Tr. Astron. observ., 13, 63-103 (from Referativnyy Zhurnal -- Fizika, No 11, Nov 58, Abstract No 24392)

Results of checking the movement of quartz clocks KKh1, KKh2, and KKh3 during 1951-1954 are presented. The clocks belong to a group frequency standard of the Khar'kov State Institute of Measures and Measuring Instruments. Investigation of "aging" of quartz clocks was carried out. The determination of coefficients of empiric formulas of "aging" of clocks is carried out by means of least squares. For the clock KKh3 a formula of the type $G = a + \frac{b}{t} + \frac{c}{t^2} + \frac{d}{t^3}$, and for KKh1 and KKh2 of the type $G = a + bt + ct^2$ is used.

Factors affecting the stability of movement of quartz clocks and the effect of these factors on the movement are described. The quartz elements belonging to the clocks KKh1, 2, and 3 have a zero temperature coefficient at a temperature about 40°C, and a nominal frequency of 60 kc. The oscillators of clocks KKh1 and KKh2 were assembled according to a rheostat-capacitance system, and KKh3, on a bridge diagram. The oscillators were placed in double thermostats, the temperature of which was measured with an accuracy up to 0.001°. The correction of the movement for temperature change was not possible, because the temperature coefficient of the frequency is a nonlinear function of the temperature. However, the absolute value of variations of the movement did not exceed the error of observed movement of the clock, which permitted disregarding temperature variations. All quartz oscillators were fed from alkaline storage batteries.

The movements of the clocks KKh1 and KKh2 were corrected by the sum of the supply line errors. The clock KKh3 did not need such correction, because its dependence of movement on voltage is small.

The final formulas of curves of the general variation of aging movements of the quartz clocks KKh1, KKh2, and KKh3 have the following aspect, respectively: $G_1 = -0.28560 - 0.002416\ t + 0.0010387\ t^2$; $G_2 = -0.14829 - 0.00273\ t + 0.0000840\ t^2$; and $G_3 = 0.01246 + 0.04713/t - 0.03000/t^2 + 0.01431/t^3$.

The computation of movements of all three clocks during 1951-1954, after taking account of aging and effects of equipment showed that the smoothed movements of all clocks are periodical functions of time, which agree well in phase and amplitude. This supplies basis for the belief that the observed variations of movement are due not to the quartz clocks, but are related to the natural time standard, the velocity of the Earth's rotation around its axis.

- 1 -

2. Sporadic Solar Radio Emission

"Possible Mechanisms of Sporadic Solar Emission (Radiation
in Isotropic Plasma)," by V. L. Ginzburg and V. V. Zhelezny-
akov, Physics Institute imeni Lebedev, Academy of Sciences
USSR, Radiophysics Institute, Gor'kiy University imeni
Lobachevskiy; Moscow, Astronomicheskiy Zhurnal, Vol 35, No 5,
Sep/Oct 58, pp 694-711

Coherent and incoherent mechanisms of sporadic solar emission in
isotropic coronal plasma are discussed. It is shown that it is impossible
to connect type II bursts with an incoherent plasma mechanism of radio
emission. A preliminary examination of reabsorption and the conditions
for the transition of plasma waves into electromagnetic radiation show
that evidently the incoherent mechanism also cannot be used for explain-
ing type III bursts. However, this latter possibility cannot be con-
sidered completely excluded. The coherent plasma mechanism, on the con-
trary, allows for the interpretation of the peculiarities of type III
bursts and in all probability of type II bursts. It is impossible to
limit the examination of high-level radio emission and type I bursts
related to sunspots, because of polarization, by considering only
isotropic plasma. The possible mechanisms of sporadic solar emission
in the case of magnetoactive plasma are discussed in a later article.

3. Radio Emission of Taurus-A

"Intensity Distribution of the Discrete Source of Radio
Emission Taurus-A," by V. A. Udal'tsov and V. V. Vitke-
vich, Physics Institute imeni Lebedev, Academy of
Sciences USSR; Moscow, Astronomicheskiy Zhurnal, Vol 35,
No 5, Sep-Oct 58, pp 713-721

The distribution of radio brightness of Taurus-A during its occulta-
tion by the Moon on 30 November 1956 was studied by the interferometric
method on 3.5 m. Data on the method of observation and the apparatus
used are given. A nonuniform distribution of radio brightness with an
increase toward the center was found. Nonradial symmetry was detected.
The source of radio emission is elongated in the southeast direction
(as also in the optical region). The ratio between the major and minor
axes of the region of radio emission is about the same as in the optical
region. The major and minor axes of the radio emission region are equal
to 9'.5 and 7', respectively. The dimensions in the α and δ directions
are about equal, 8'5. A displacement of the radio emission region with
respect to the optical in the southeast direction was found. The regions
of maximum radio brightness and maximum optical brightness are also
relatively displaced by about 2'. The derived results are discussed,
assuming the mechanism of emission by relativistic electrons.

4. Cosmic Radio Emission

"Peculiarities of the Magnetodecelerating Mechanism of Nonthermal Radio Emission," by G. G. Getmantsev, Radio-physics Institute, Gor'kiy University imeni Lobachevskiy; Moscow, Astronomicheskiy Zhurnal, Vol 35, No 5. Sep-Oct 58, p 722-729

It is shown that if cosmic electrons, responsible for nonthermal cosmic radio emission, are supplied to the periphery of the Galaxy by sources concentrated in the galactic plane, then the adiabatic invariant is not conserved when the particles move in an interstellar magnetic field. The possibility of formation of relativistic electrons as a result of nonreversible collisions of relativistic protons with atoms of the interstellar medium, as suggested by V. L. Ginzburg (Izv. AN SSSR, Ser, fiz., 20, No 1, 1956), is discussed.

5. Solar Spot Spectrum

"Theoretical and Observed Equivalent Widths of Some Strong Lines in the Sunspot Spectrum," by V. S. Berdi-chevskaya, Moscow Engineering Construction Institute imeni Kuybyshev; Moscow, Astronomicheskiy Zhurnal, Vol 35, No 5, Sep-Oct 58, pp 730-737

The comparison of observed equivalent widths of strong lines and those calculated by J. C. Pecker's method (Ann. Astrophys., 14, No 1, 1951) gives a possibility of checking the model of the structure of sunspots suggested by R. Michard (Ann. Astrophys., 16, No 4, 217, 1953). The equivalent width of Mg 5184 deduced on the basis of this model does not agree with P. Ten Bruggencate's observations (Z. Astrophys., 18, 330, 1939). The comparison of the observed and calculated equivalent widths W shows that the gas and electron pressure in the spot adopted by Michard are too low. If the pressure is derived assuming that there is mechanical and ionizational equilibrium and that the temperature distribution is the same as for Michard's model, then the calculated model gives too-high values of W. However, the latter are closer to the observed W than those found if Michard's model were adopted. Analogous calculations for Ca I 4227 and Al 3961 qualitatively lead to the same results.

The author thanks associates of the chair of astrophysics of the State Astronomical Institute imeni Shternberg for assistance.

6. Velocity Field in Sunspots

"The Structure of the Velocity Field of Motions in Latitude on Nonrecurring Sunspots," by M. A. Klyakotko, State Astronomical Institute imeni Shternberg; Moscow, Astronomicheskiy Zhurnal, Vol 35, No 5, Sep-Oct, 58, pp 739-747

The existence of a structure in the velocity field of motions in latitude of nonrecurring sunspots is shown. A table with the distribution in latitude of the mean velocities of motion in latitude of nonrecurring sunspots (for the period 1877-1887) is given. The extrema of the curves of velocity distribution in latitude have been identified and their correlation for different years calculated.

7. Attraction of Two Ellipsoids

"The Development of the Potential Function of the Mutual Attraction of Two Ellipsoids (Homogeneous and Nonhomogeneous)," by V. T. Kondurar, Ivanovskiy Power Engineering Institute; Moscow, Astronomicheskiy Zhurnal, Vol 35, No 5, Sep-Oct 58, p 763-771

In previous works (Uch. zap. Ivan. ped. in-ta. 5, 103, 1954; ibid. 10, 97, 1956) the author analyzed particular cases of the general problem discussed. In the general problem the ellipsoids are supposed to be arbitrarily situated relative to one another and one ellipsoid is supposed to be homogeneous and the other nonhomogeneous. The derivation of the mutual potential of the ellipsoids in finite form is an insuperable problem and therefore the mutual potential of the two ellipsoids is expanded into infinite series, according to the powers of the inverse distance between their centers and convenient formulas for its coefficients are found. The derived expansion has an especially simple structure if an ellipsoidal distribution of densities of the two ellipsoids is assumed. As a particular case of the general problem the potential of two homogeneous ellipsoids or two spheres is immediately obtained. Approximate formulas are derived for use in the theory of rotation of the Earth and Moon, and for the determination of precession and nutation of the Earth and the libration of the Moon.

- 4 -

8. Observations of the Lunar Surface

"The Threshold of Color Distinction During Visual Observations of the Lunar Surface and the Maximal Color Difference of Lunar Objects," by L. N. Radlova and V. V. Sharonov; Moscow, Astronomicheskiy Zhurnal, Vol 35, No 5, Sep-Oct 58, pp 788-791

A series of experiments was carried out for the study of the threshold of color distinction. The color of the comparison field of a Rosenberg astrophotometer viewed on the background of the lunar disk was varied by means of a blue wedge and the degree of color distinction estimated by the observers. It was found that the difference in color for which $\triangle C$, difference of normal color indices, exceeds $0^m.1$ are noted immediately, while for $\triangle C$ less than $0^m.01$ they are not distinguished at all.

It follows that since it is difficult to distinguish the maximal differences in color on the lunar surface, the values of $\triangle C$ must lie within the above limits and comprise only several hundredths of the color index. This is confirmed by direct measurements of lunar objects, the color of which differs most.

9. Observations of Sputniks

"The Determination of the Photographic Position of a Sputnik Using Two Reference Stars," by A. N. Deych, Main Astronomical Observatory, Academy of Sciences USSR; Moscow, Astronomicheskiy Zhurnal, Vol 35, No 5, Sep-Oct 58, pp 810-818

A method of determining the photographic position of a sputnik by direct reference to two stars with known equatorial coordinates is given. Limiting the calcultations to second order terms, the results can be found with a precision of 1^S in α and $0'.2$ in δ for declination $\leqslant 60^o$, distances between the reference stars $\leqslant 5^o$ and the distance from the optical center $\leqslant 15^o$. In some cases for larger declinations it is necessary to take third order terms into account.

10. <u>Use of Solar Energy</u>

<u>Referativnyy Zhurnal -- Astronomiya i Geodeziya,</u> No 3,
Mar 58

Abstracts No 1865-1883 cover articles on utilization of solar
energy taken from the symposium <u>Ispolzovaniye Solnechnoy Energii</u> (The
Use of Solar Energy), Moscow, 1957. Titles of the articles represented
are as follows:

"Possibilities for the Use of Solar Energy," by V. A. Baum, pp 7-23
(Abstract No 1865)

"The Coefficient of Capture by a Receiver of Radiation Reflected
From Parabolic Cylindrical and Paraboloid Mirrors," by V. B. Veynberg,
pp 32-40 (Abstract No 1866)

"Spectral Characteristic of Solar Radiation Receivers," by V. B.
Veynberg, pp 41-48 (Abstract No 1867)

"The Investigation of Reflecting Surfaces of Solar Equipment," by
B. A. Garf. M. S. Borozdina, and N. B. Rekant, pp 49-61 (Abstract No 1868)

"The Rotating Mechanisms of Mobile Solar Equipment," by B. A. Garf,
pp 62-84 (Abstract No 1869)

"Solar Equipment of High Power," by R. R. Aparisi, V. A. Baum, and
B. A. Garf, pp 85-98 (Abstract No 1870)

"Technological Peculiarities of the Preparation of Reinforced Con-
crete Paraboloid Mirror Reflectors of Helioinstallations and Some Indexes
Their Operation," by G. I. Markov, pp 99-109, (Abstract No 1871)

"Thermotechnical Investigations of a Solar Paraboloid Installation
Steam Production," by B. K. Kozlov, F. F. Bogdanov, Ya. G. Kolos, and
G. I. Markov, pp 110-117 (Abstract No 1872)

"Test of a Solar Refrigerator," by P. M. Brdlik, 118-123 (Abstract
No 1873)

"Heating of Buildings by Solar Energy," by D. M. Shchegolev, pp 124-
135 (Abstract No 1874)

- 6 -

"Test and Computation of Solar Irrigation Equipment," by P. M. Brdlik, pp 136-150 (Abstract No 1875)

"Experimental Equipment for Obtaining High Temperatures," by R. R. Aparisi, pp 151-162 (Abstract No 1876)

"A Small Solar Kitchen," by B. A. Garf, pp 163-171 (Abstract No 1877)

"Parabolic-Cylindrical Equipment With an Output of 40 Liters of Boiling Water per Hour," by B. A. Garf and R. K. Khuntsariya, pp 172-176 (Abstract No 1878)

"A Computation Method for Solar Water Heaters," by B. V. Petukhov, pp 177-201 (Abstract No 1879)

"Tests of Solar Water Heaters in Tashkent in 1952-1953," by G. I. Markov and N. B. Rekant, pp 202-209 (Abstract No 1880)

"The Shading Coefficient of Direct Solar Radiation by a Glass Shield on a Helioreceiver and the Amount of Direct Solar Radiation Incident to the Receiver," by G. I. Markov, pp 210-213 (Abstract No 1881)

"Technical and Economic Indexes of Solar Plants," by S. G. Poyarkov, pp 214-231 (Abstract No 1882)

"Possibilities of Using Solar Energy for Drying Fruits and Vegetables," by A. A. Ismailova, pp 232-247 (Abstract No 1883)

11. Ion Concentration in the Solar Corona

"Determination of Ion Concentration in Separate Coronal Rays From Noneclipse Pictures," by M. G. Karimov, Izv. Astrofiz. in-ta AN KazSSR. 1957, 5, No 7, pp 73-79 (from Referativnyy Zhurnal, Astronomiya i Geodeziya, No 3, Mar 58, Abstract No 1854)

A method suggested by I. S. Shklovskiy is briefly related (Solnechnaya Korona [Solar Corona], 1951). It concerns the determination of ion concentration in an excited state for a spherically symmetrical corona model.

The author suggests investigating separate coronal formations, condensations or "rays." The 8 March 1956 spectra were obtained by means of the coronograph of the Astrophysical Institute as well as pictures of the structure of the corona in the line 5303. For five rays the equivalent line widths of CO were determined in absolute units ($14 - 32 \cdot 10^6$ of the Sun) and of the half width ($0.70 - 0.98$ A) λ 5303.

Photometry of the ray and of the interray space in radial directions was carried out. The brightness of 5303 has a maximum at a mean distance of 31" from the limb. The falloff of the curve may be expressed by $I \sim \rho^n$, where ρ is expressed in parts of the solar radius; $n = 25.8$. By assuming that the thickness along the line of sight for the ray equals its visible width, the space luminosity and the ion concentration in the excited state ($321 - 661$) are determined. The value found by Shklovskiy is 650.

12. Spectrum of the Solar Corona

"Testing of the Corona Spectrograph and the Temperature Determination of the Inner Corona by Means of Noneclipse Spectra," by M. G. Karimov and S. O. Obashev. _Izv._ _Astrofiz. in-ta AN KazSSR_, 1957, 5, No 7, pp 66-72 (from _Referativnyy Zhurnal -- Astronomiya i Geodeziya_, No 3, Mar 58, Abstract No 1853)

The spectrograph was constructed in the Astrophysical Institute of the Academy of Sciences Kazakh SSR. The spectrograph has mirror optics (a collimator 13 cm/50 cm; camera F = 50 cm; the grating 45×65 cm^2; the dispersion 10.5 A/mm in the third order). Constructed according the line Ne 5852.4 the instrument profile may be described by the Gauss curve with a half width of 0.42 A. The results of processing the line 5303, obtained on 18 March, 15 and 16 May, and 27 July 1956, are given. The standardization is over the Sun with its light weakened $10^5 - 10^6$ times by a smoky filter and diaphragm. By using observations of lines 5303 and 6374 in position angles differing by 6°, and assuming that the temperature in both regions of the lines is the same, the writers determine the velocity of turbulence.

- 8 -

II. CHEMISTRY

Analytical Chemistry

13. A New Mass Spectrometer for the Analysis of Gas Mixtures

"Brief News Items -- USSR" (unsigned article); Moscow,
CPYRGHT Atomnaya Energiya, Vol 5, No 5, Nov 58, p 594

> "An inertia-free analyzer PGA-1 for multicomponent gas mixtures
> has been developed which operates on the principle of a nonmagnetic
> pulse mass-spectrometer. The gas to be analyzed is conducted into the
> sensing unit (datchik) of the apparatus consisting of an ion source, a
> space through which the ions move, and an ion receiver. The atoms and
> molecules of the gas are ionized in the generator. Because of differences
> in the time required by the ions to cover the distance involved, these
> ions are separated according to their masses. The apparatus makes it
> possible to investigate gases · with mass numbers from 2 to 70. The
> resolving capacity of the apparatus measured on the basis of the width
> of the peaks at 1/2 of their height comprises approximately 30 in the
> vicinity of the mass 30. The apparatus makes it possible to record
> changes in the composition of the gas mixture taking place in the ion
> generator during the time required for taking a single spectrum, viz.,
> ~0.002 sec."

[For additional information on analytical chemistry, see Item No 37.]

Chemistry and Technology of Fuels and Propellants

14. A Centrifugal Rectifier for the Production of Liquid Oxygen

"A Horizontal Centrifugal Rectifier", by Prof S. Ya. Gersh
(deceased), Doctor of Technical Sciences, and Engr A. M.
Arkharov; Moscow, Kislorod, Vol 11, No 5, Sep/Oct 58, pp 1-10

In the course of work on new low-temperature installations, the ne-
cessity arose of designing distillation equipment of small dimensions
which is capable of operating under conditions involving vibrations, shak-
ing, and inclination of the rectifying device down to angles of 45-50°.
In the solution of this problem it has been decided to use a horizontal
centrifugal device in which film rectification takes place and in which
there is forced movement of the liquid phase only.

An experimental horizontal centrifugal rectifier has been constructed
and investigated in which air is fractionated at low temperatures and
which produces up to 14 kilograms of oxygen per hour. It was established
that a very high degree of separation in a single stage rectification is
obtained with the use of this rectifier. The degree of separation of oxy-
gen comprises 57-62% at a purity of the oxygen amounting to 99.2-99.5%
and a content of the oxygen in the rejected nitrogen amounting to 9-10%.
The rectifier has considerably smaller dimensions than ordinary distilla-
tion columns and can operate under shaking at an inclination down to 70°
in any plane. The quantity of the liquid retained is very small (the
thickness of the liquid film comprises only 0.2-0.3 millimeter), which
contributes to rapid starting and high speed in reaching a steady distri-
bution of concentrations. The danger of a breakdown of the liquid film
is excluded.

The conditions of the flow of the liquid film moving in the rotating
inclined channel countercurrently to the vapor have been established. The
limiting conditions which result in flooding and the maximum efficiency
of the rectifier have been determined. On the basis of the experimental
data an equation has been formulated which describes the mass transfer.
A method for the calculation of equipment of this type has been developed.
It has been demonstrated that it is possible to design centrifugal recti-
fiers of oxygen with an output of 1,000 kg of O_2 per hour or higher.

15. A Plant for the Production of Liquid Hydrogen

"The VOS-3 Plant for the Liquefaction of Hydrogen," by A. B. Fradkov, Candidate of Technical Sciences; Moscow, Kislorod, Vol 11, No 5, Sep-Oct 58, pp 21-28

It is pointed out that there is an increased demand for liquid hydrogen at scientific research institutes and enterprises which use this hydrogen for producing low temperatures down to 10° K and in a number of cases employ it in research involving the use of liquid hydrogen as a target, its application in bubble chambers, etc. To satisfy the demand for liquid hydrogen, the Institute of Physical Problems, Academy of Sciences USSR, has designed a prototype plant for the liquefaction of hydrogen designated by the symbol VOS-3 [Hydrogen Liquefaction Plant No 3]. Installations of this type are being produced at present by the First Moscow Autogenous [Welding] Plant. The output of a VOS-3 plant is 8-10 liters of liquid hydrogen per hour. Ordinary technical electrolytic hydrogen is liquefied. In developing the design of VOS-3 plants, the experience of many years in the liquefaction of hydrogen acquired at the Institute of Physical Problems was used, particularly the results of work done by Academician T. L. Kapitsa and the experience acquired in the operation of VOS-2 plants designed by the Institute of Physical Problems. The design and operation of the VOS-3 plant are described in detail. The safety measures to be applied in the operation of hydrogen liquefaction plants are discussed at the end of the article.

16. The Kinetics of the Formation of Acetylene in Hydrocarbon Flames

"The Physicochemical Basis of the Process of Formation of Acetylene in Hydrocarbon Flames," by P. A. Tesner, All-Union Scientific Research Institute of Natural Gas, Moscow; Budapest, Magyar Kemiai Folyoirat, Vol 64, No 9, Sep 58, pp 343-348

The thermodynamic calculation of the process involved is based on the circumstance that the equilibrium in water gas between H_2, CO, CO_2, and H_2O is also [ordinarily] established in the case of incomplete combustion of methane in flames. Acetylene is thermodynamically unstable: it is not in equilibrium with the other components of the mixture and its presence is the result of rapid cooling of the flame. The carbon black that is formed constitutes a product of the decomposition of acetylene. The quantity of carbon black that is formed serves as a measure of the degree of decomposition of the acetylene.

In the course of the investigation of the kinetics of the process of formation of acetylene which is described, the author established on the basis of gas samples taken from different points of the flame that acetylene is formed in a very thin layer which is immediately adjacent to the boundary of the oxygen zone. One may therefore assume that acetylene is not formed during the process of combustion, but represents a product of simple thermal decomposition of residual methane.

The experimental data obtained indicate that the mechanism of the reaction is the same in laminar as in turbulent flames.

[For additional information on chemistry and technology of fuels and propellants, see items No 52 and 53.]

Chemistry and Technology of Nuclear Fuels and Reactor Construction Materials

17. Hydrolysis and Decomposition of $Na_4 UO_8 . 9 H_2O$

"Investigation of the Hydrolysis and Decomposition of $Na_4 UO_8 . 9 H_2O$ in Dilute Solutions," by A. M. Gurevich and L. D. Preobrazhenskaya; Moscow, Zhurnal Neorganicheskoy Khimii, Vol 3, No 11, Nov 58, pp 2512-2522

New data are reported on the basis of which it was possible to clarify the conditions under which the unhydrolyzed ion $[UO_8 . n H_2O]^{4-}$ exists and the conditions under which it is in equilibrium with some products of hydrolysis and decomposition.

18. Extraction of Thorium and Uranium With Alkyl Phosphates

"Application of Alkyl Phosphates in the Analytical Chemistry of Uranium and Thorium; Extraction of Uranium With Dibutyl Phosphate and its Determination With the Aid of Morin," by A. Kiss and Gy. Almassy, Chemical Department of the Experimental Atomic Reactor, Central Physics Research Institute; Budapest, Magyar Kemiai Folyoirat, Vol 64, No 9, Sep 58, pp 332-336

The extraction of uranyl nitrate and thorium nitrate with dibutyl phosphate and tributyl phosphate was investigated. It was established that thorium in the form of its nitrate, as distinguished from uranium, is extracted by dibutyl phosphate in the form of a molecular compound rather than a complex.

The optimum conditions for the separation of uranium by extracting it with tributyl phosphate are described. After the separation uranium is determined with morin in a weakly acidic hydrochloric acid solution which contains alcohol. The light absorption by uranium in aqueous solutions follows the Lambert-Beer law up to a uranium content of 400 gamma.

19. A New Uranium Mineral

"Arsenuranylite, an Arsenic Analogon of Phosphuranylite," by L. N. Belova; Moscow-Leningrad, Zapiski Vsesoyuznogo Mineralogicheskogo Obshchestva, Series 2, Part 87, No 5, Sep/Oct 58, pp 598-602

The characteristics of arsenuranylite, an arsenic analogon of phosphuranylite discovered by the author in 1954, are described. It is stated that phosphuranylite has been confused with pitchblende (uranovaya slyudka) because of the similar composition of the two minerals and that this confusion has been carried over into USSR handbooks of uranium minerals.

20. Extraction of Plutonium With Tributyl Phosphate

"The Effect of Mono- and Dibutyl Phosphates on the Extraction of Plutonium With Tributyl Phosphate," by V. B. Shevchenko and V. S. Smelov; Moscow, Atomnaya Energiya, Vol 5, No 5, Nov 58, pp 542-545

The coefficients of the distribution of mono- and dibutyl phosphates between the organic phase containing tributyl phosphate in hydrated kerosene on the one hand and water or aqueous solutions of nitric acid, caustic, and soda on the other hand were determined. It was established that concentrations of monobutyl phosphate lower than 0.01 mols per liter (this is the equilibrium concentrations) and of dibutyl phosphate lower than 0.001 mol per liter have practically no effect on the extraction of plutonium with tributyl phosphate.

21. Electrolytic Procedures for the Production of Rare Elements Used In Nuclear Technology

"Electrolysis in the Chemistry and Technology of Rare Elements," by Prof S. I. Sklyarenko; Moscow, Khimicheskaya Nauka i Promyshlennost', Vol 3, No 4, Aug 58, pp 455-463

Electrolytic procedures for the isolation and production of rare elements are reviewed on the basis of USSR and non-USSR publications. A bibliography consisting of 28 USSR references and 50 non-USSR references is

appended to the article. It is stated in the introduction to the articles that the chemistry and technology of rare elements has progressed at a particularly fast rate during recent years. This is related to the development of nuclear energy technology: it is pointed out that uranium, thorium, lithium, zirconium, tantalum, and niobium can be produced by electrolytic methods and that the last three metals are used as structural materials in nuclear technology.

Electrolysis of melts to produce rare elements, electrolysis of melts to produce alloys of rare elements, electrolysis of aqueous solutions to produce rare elements or alloys of these elements, and the application of electrochemical methods for the solution of special problems are reviewed. In the section on the electrolysis of melts to produce rare elements it is pointed out that the majority of rare metals are higher in the electromotive series than hydrogen and for this reason cannot be isolated by the electrolysis of solutions. Methods to be applied with the view of assuring the highest degreee of purity of the metals deposited electrolytically are discussed. A discussion of electrolytic refining and a description of processes for obtaining titanium, zirconium, tantalum, and niobium by the electrolysis of melts are included. The electrolytes (salt fluxes) proposed as media for the production of rare metals by the electrolysis of fusions are listed. The production of elemental boron by the electrolysis of melts is considered at the end of this section.

The section on the production of alloys of rare elements by the electrolysis of melts deals to a considerable extent with technical alloys of rare-earth metals. Rare-earth metal alloys of aluminum and magnesium obtained in this manner and alloys of zirconium with magnesium are considered with a reference to the fact that alloys of this type are heat-resistant and can be used as structural materials for parts of reaction engines. The electrolytic production of lithium, beryllium, and of lithium-calcium alloys is also discussed. A description of a procedure for the production of tantalum-niobium alloys of all compositions starting with pure tantalum and ending with almost pure niobium is given. Separation of individual elements from alloys obtained in this manner by the application of the method of fractional distillation is mentioned with particular reference to rare-earth metals.

A considerable portion of the section on the production of rare elements and their alloys by the electrolysis of aqueous solutions deals with rhenium. It is stated that because of its useful characteristics rhenium is beginning to play a considerable role in the industry. However, the low content of rhenium in the Earth's crust and the high degree of dispersion of this metal preclude its production in large quantities. For this reason, according to the author, the possibilities of applying coatings of rhenium or rhenium alloys are of particular importance. Techniques for depositing electrolytically coatings of rhenium alloys are described.

- 14 -

The section on the application of electrochemical methods for the solution of some special problems discusses the separation of rare-earth elements, production of tungsten and niobium by depositing these metals from phosphate solutions, and the electrochemistry of actinoids. The production of pure uranium, pure metallic thorium, and the electrolytic isolation from solutions of plutonium, americium, and curium are described. It is stated at the conclusion of the article that most of the work on the electrochemistry of rare elements is of a purely empirical character. A more thorough investigation of the physicochemical properties of rare elements from this standpoint is recommended.

22. Papers on the Geology of Nuclear Fuel Raw Materials at the Second Geneva Conference

"Geology of Nuclear Mineral Resources," by M. M. Konstantinov; Moscow, Atomnaya Energiya, Vol 5, No 5, Nov 58, pp 558-563

Papers presented at the Second International Conference on Peaceful Uses of Atomic Energy, Geneva, 1958, are reviewed. It is noted that during the past 3 years the situation with regard to the supply of raw material for the production of uranium improved as far as the principal consumers of this material, particularly the US, are concerned. At the same time, the majority of countries which are trying to develop a nuclear energy industry have not yet satisfactorily solved the problem of self-sufficiency in regard to a supply of raw material for nuclear fuel. The reports presented at the conference illustrate the persistence with which the search for uranium deposits is conducted by a number of countries, particularly France, Japan, Argentina, and some others. However, the small measure of success attained by these countries up to now in prospecting for uranium testifies to the fact that the problem of nuclear raw material will not be solved for a long time.

According to the author, the papers on the geochemistry of uranium and thorium dealt principally with the following problems:

1. Utilization of the isotope method in the investigation of the geochemistry of radioactive elements.

2. Investigation of geochemical correlations between uranium and the formation or deposition of organic substances contained in alluvial rocks (residual petroleum products, substances derived from plant material, etc.).

3. The geochemistry of the zone of oxidation of uranium deposits.

The report presented by A. P. Vinogradov under the title "Meteorites and the Earth's Crust (Geochemistry of Isotopes)" (Conference Paper No 2523) is reviewed in detail. It is stated that the data presented in this paper

- 15 -

and the conclusions made by Vinogradov are not only of theoretical interest, but also of practical importance, because new geochemical criteria to be used in prospecting for uranium have been established. After reviewing the papers on the geochemistry of uranium and thorium, the author discusses papers on other subjects in the general subdivisions of the formation of deposits of different types, the minerology of uranium, regional reviews, papers describing individual deposits, the geological basis of prospecting for uranium deposits, methods of prospecting for uranium deposits, methods of prospecting for uranium, new radiometric equipment, and papers on lithium, beryllium, and zirconium. In the section on the formation of individual deposits, the author criticizes P. F. Karr's report on the formation of uranium deposits in the Colorado Plateau (Conference Paper No 768). The section on methods of prospecting for uranium deposits pays principal attention to radiometric methods: the information given in US papers on the subject is summarized in some detail.

As far as new radiometric equipment is concerned, the author says that the new device developed in Japan which combines a scintillometric counter with a lead screen is of particular interest. (This device is described in Conference Paper No 1538 presented under the title "The Uranoscope, an Electronic Locator of Radiation Sources Which Operates on the Radar Principle" -- cf. "Complete List of All Papers Presented at Geneva," Atomnaya Energiya, Vol 5, No 3, September 1958, p 371). He states that the rotating type of mounting embodied in the design of counters of this type makes it possible not only to record the intensity of the radiation, but also to determine the direction from which the radiation, comes and consequently locate the radioactive material which acts as the source emitting the radiation.

As far as geochemical methods of prospecting are concerned, it is stated that successful work on this subject is being done in the US, France, Japan, the Union of South Africa, and some other countries. It is added to this that at present geochemical procedures form an essential part of the methods used in prospecting for uranium. In regard to lithium, beryllium, and zirconium, which are referred to as auxiliary material in the production of nuclear energy, it is stated that the geology of these elements, toward which great interest was evinced after the first Geneva conference, has been discussed only to a partial extent in the reports presented at the second Geneva conference.

- 16 -

23. The Stability of Ion-Exchange Resins to Gamma Radiation

"The Stability of Ion-Exchange Resins in Aqueous Solutions to
the Action of Gamma Radiation Emitted by Co^{60}," by Ch'ang Tsuan
Man-wei, A. I. Chernova, and M. A. Proskurnin; Moscow, Atomnaya
Energiya, Vol 5, No 5, Nov 58, pp 573-575

The stability of the SDV-3 (styrene sulphonic acid + divinyl benzene
sulfonic acid) and MMG-1 ion-exchange resins immersed in aqueous solutions
toward the action of gamma radiation emitted by a Co^{60} source was investi-
gated. The ion-exchange resins were irradiated in the hydrogen form
(SDV-3) and the hydroxyl form (MMG-1). As the liquid phase, water and
solutions of sodium chloride, sulfuric acid, and acetic acid were used.
In the series of experiments in salt solutions the cation-exchange SDV-3
was also irradiated in its sodium salt form. The physicochemical charac-
teristics of the resins were determined according to the methods given
in COST -- 4, No 5695, group L-99. For the resin SDV-3, the static volume
capacity toward the uranyl ion was also determined. The methods used are
described in some detail. The properties of the resins before and after
irradiation are presented in tabular form.

24. Oxidation of Zirconium at High Temperatures

"Oxidation of Zirconium at High Temperatures and the Structure
of the Primary Oxide Films That Are Formed," by E. S. Sarkisov,
N. T. Chebotarev, A. A. Nevzorova, and A. I. Zver'kov; Moscow,
Atomnaya Energiya Vol 5, No 5, Nov 58, pp 550-553

Investigation of the oxidation of zirconium by ambient oxygen and water
vapor in the temperature range of 150-800° showed that the oxidation process
passes through several stages. In the first stage of oxidation, there is
formation of a thin film with a pronounced structure corresponding to a
cubic modification. This film has a high capacity to passivate corrosion.
The second stage is characterized by the appearance of a structural mono-
clinic modification which is located under the cubic modification. Fur-
ther thickening of the film proceeds by growth of the lower monoclinic
modification. The third stage of the oxidation is characterized by the
disappearance of the structure of the black film consisting of the cubic
and monoclinic modifications and transformation of this film into a white
film. During this process, the rate of oxidation of zirconium increases
sharply. The high stability of the black film to corrosion is correlated
with the presence of a structurized solution of zirconium in $Zr O_2$. It
was demonstrated that the protective effect of the black film apparently
disappears on maximum saturation with oxygen of the solid solution com-
posing this film. As a result of this, nonstructurized zirconium dioxide
is formed which is white in color and exhibits a stoichiometric composition
corresponding to $Zr O_2$.

- 17 -

25. The Behavior of Hydrochloric Acid Solutions of Pentavalent Niobium

"On the Nature of Hydrochloric Acid Solutions of Pentavalent Niobium," by S. I. Solov'yev and Ye. I. Krylov, Ural Polytechnic Institute imeni S. M. Kirov; Moscow, Zhurnal Neorganicheskoy Khimii, Vol 3, No 11, Nov 58, pp 2487-2490

In connection with the possibility of using hydrochloric acid solutions of niobium pentoxide to separate niobium from titanium with the aid of cation-exchange resins, data obtained in studying the state of niobium in these solutions by the methods of dialysis, measurement of electric conductivity, and determination of viscosity are of interest, particularly as far as the behavior of niobium at low concentrations of hydrochloric acid is concerned. To obtain such data, the investigation reported in this instance was carried out. It was established that a hydrochloric acid solution of niobium oxychloride does not pass through parchment diaphragms. It was furthermore established that during the process of dialysis of such solutions there is gradual transformation of niobium oxychloride into a gel of niobic acid. It was found that the gel of niobic acid is of an irreversible type and exhibits tixotropy. The sign of the charge of colloidal particles and the ζ -electrokinetic potential of niobic acid sols were determined.

26. Lower Oxides of Niobium

"On Lower Oxides of Niobium," by S. I. Alyamovskiy, G. P. Shveykin, and P. V. Gel'd; Moscow, Zhurnal Neorganicheskoy Khimii, Vol 3, No 11, Nov 58, pp 2437-2444

An investigation by the X-ray diffraction method of phase components of the system Nb-O obtained by the reduction of niobium pentoxide with metallic niobium and carbon at 1,200° and 1,580-1,650° was carried out.

27. The System $NaF-BeF_2$

"The Constitutional Diagram of the System $NaF-BeF_2$", by A. V. Novoselova, M. Ye. Levina, and M. P. Savel'yeva; Moscow, Zhurnal Neorganicheskoy Khimii, Vol 3, No 11, Nov 58, pp 2562-2570

The constitutional diagram of the system $NaF-BeF_2$ was constructed. The method of thermal analysis was used to obtain the data required.

- 18 -

28. Thermodynamics of the Reduction of Beryllium Oxide by Carbon

"Investigation of the Thermodynamics of the Reduction of Beryl-
lium Oxide by Carbon," by M. V. Smirnov and N. Ya. Chukreyev,
Laboratory of Electrochemistry, Ural Affiliate of the Academy
of Sciences USSR; Moscow, Zhurnal Neorganicheskoy Khimii, Vol 3,
No 11, Nov 58, pp 2445-2449

The EMF of the electric cell Be/ NaCl, KCl, $BeCl_2$ melt/ BeO + C was
measured in the temperature range of 682-1040°. Using the experimental
data obtained, the change in the isobar potential of the reaction

$$Be_{solid} + 1/2 \ CO_{2 \ gas} = BeO_{solid} + 1/2 \ C_{(graphite)}$$
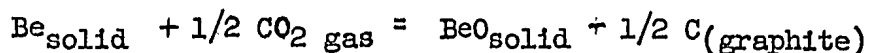
with the temperature was determined. On the basis of the experimental data
obtained and data published in the literature, standard values for the heat
of formation and entropy of beryllium oxide were calculated.

29. Polarographic Investigation of Salts of Rare-Earth Metals

"Polarographic Investigation of the Salts of Rare-Earth
Elements and the Systems Formed by Them with Some Complex-
Forming Compounds; Part 2," by N. A. Kostromina and S. I.
Yakubson; Moscow, Zhurnal Neorganicheskoy Khimii, Vol 3,
No 11, Nov 58, pp 2506-2511

The values of the half-wave potential, i_d/c, and the slope of log-
arithmic straight lines have been determined for solutions of ytterbium
chloride. The values for the height of the diffusion current wave of
the ytterbium cation are compared with the corresponding values for other
rare-earth element cations that have been investigated. The polaro-
graphic behavior of solutions of lanthanum and cerium chlorides and sul-
fates in hydrochloric and sulfuric acid solutions has been investigated.
By using the polarographic method, formation of complexes in solutions
of ytterbium chloride containing sodium lactate, gluconate, tartrate,
or citrate as the complex-former was studied. It was established that
at concentrations of the complex-former (lactate, tartrate, or gluconate)
up to 0.1 mol the reduction is reversible and takes place with the participation
of one electron. At higher concentrations, the reduction is irreversible. Formulas
are proposed for the complexes formed by tetravalent and divalent ytterbium, and a
scheme is suggested for the reaction which takes place at the electrode. The dissociation
constants of the complexes formed by these two ions are listed. These constants have
been calculated by using an equation which relates differences of half-
wave potentials to the values of p—q (p and q are coordination numbers
for the 3- and 2- valent ions of ytterbium).

- 19 -

30. Complex Acids of Rare-Earth Elements With Ethylenediaminetetracetic Acid

"Some Properties of the Complex Acids Formed by Rare-Earth Elements With Ethylenediaminetetracetic Acid," by N. E. Mitrafonova, L. I. Martynenko, and G. K. Yeremin, Chair of Inorganic Chemistry, Moscow State University; Moscow, Zhurnal Neorganicheskoy Khimii, Vol 3, No 11, Nov 58, pp 2496-2505

A few years ago it was proposed to use complex compounds formed by rare-earth elements with ethylenediaminetetracetic acid (H_4 V) for the separation of these elements by the methods of fractional precipitation, fractional crystallization, and ion-exchange chromatography. In connection with the practical application of complex compounds of this class, data on their structure and characteristics are of importance. In the investigation described in this instance, the composition of a number of hydrates of rare-earth complex acids with H_4 V and the solubilities of these acids have been investigated. It was established that the complex acids formed by H_4 V with rare-earth elements form hydrates of different composition and solubility depending on the conditions under which the compounds have been synthesized. At low temperatures the elements of the cerium group form complex acids with a whole number of water molecules. Crystals of anhydrous complex acids precipitate from boiling solutions. These anhydrous complex acids have a low solubility in water. The elements of the yttrium group also form hydrates of different composition depending on the temperature at which the compounds were synthesized, in the majority of cases hydrates with a fractional number of water molecules. Water plays only a minor role as a structural constituent of these acids. Anhydrous acids derived from elements of the yttrium group could not be obtained by boiling the solutions. It is concluded on the basis of the results obtained that in order to separate complex acids of the cerium groups from complex acids of the yttrium group by fractional precipitation one should precipitate anhydrous acids. To separate elements of the cerium group from each other, one should synthesize hexahydrates, which differ greatly from each other with regard to their solubility.

31. Oxidative Potentiometric Titration of Complex Titanium Oxalates

"Oxidative Potentiometric Titration of Complex Titanium Oxalate," by A. A. Grinberg and L. V. Shikheyeva; Moscow, Zhurnal Neorganicheskoy Khimii, Vol 3, No 11, Nov 58, pp 2491-2495

It was found that in all compounds in which the oxalate groups are located next to a central atom which is capable of being oxidized, oxidation of this atom takes place first and proceeds separately from that of the oxalate groups. This applies to tetravalent uranium, trivalent titanium, and ferrous iron. In compounds the oxidized central atom of

which is slowly reduced by oxalate ions under conditions existing during the titration, there may be simultaneously partial titration of a part of the oxalate groups in the first potential jump (for instance, during the oxidation of U (IV) oxalate). In compounds in which the oxidized central atom is for all practical purposes not reduced by oxalate groups under the conditions of titration, the first potential jump corresponds precisely to the termination of the oxidation of the metal (e.g., trivalent titanium). Stepwise oxidation of oxalate groups has been observed hitherto only in the case of plantinum compounds with oxalate groups in the inner sphere.

32. Elimination of Radioactive Cesium by Means of Prussian Blue

"The Mechanism of the Capture of Microquantities of Cesium by Prussian Blue," by M. Krs and O. Ye. Zvyagintsev, Moscow Chemicotechnological Institute imeni Mendeleyev and Military Technical Academy imeni A. Zapotocki at Brno; Moscow, Zhurnal Neorganicheskoy Khimii, Vol 3, No 11, Nov 58, pp 2582-2592

Several years ago it was proposed to use ferrocyanides of heavy metals for the elimination of radioactive cesium from dilute solutions of different origin. However, the mechanism of the capture of cesium by ferrocyanides had not been investigated. The mechanism of the coprecipitation of microquantities of cesium with the ferrocyanide of ferric iron has therefore been studied in the work described. Methods developed by V. G. Khlopin's school were used. The results obtained are reported in detail. On the basis of the results obtained, it is concluded that in view of the high percentage of cesium coprecipitated with Prussian blue, coprecipitation with this compound is suitable for the separation of cesium from dilute solutions. It was found in the work in question that the method of isotope exchange makes it possible to distinguish between surface adsorption and other types of coprecipitation. The experimental data obtained indicate that although some surface adsorption takes place, the coprecipitation of cesium is due principally to the formation of anomalous mixed crystals without a lower limit of mixing.

Industrial Chemistry

33. Developments in the Field of Heat-Resistant Polymers

"Status and Problems of the Chemistry of Plastics," by K. A.
Andrianov, Corresponding Member, Academy of Sciences USSR;
Moscow, Vestnik Akademii Nauk SSSR, Vol 28, No 7, Jul 58,
pp 19-25

The decisions of the May 1958 Plenary Session of the Central Commit-
tee CPSU provide for an eightfold increase in the production of plastics
in 1959-1965. Work on the synthesis of new linear polymers (polyamides,
polyesters, polyformaldehydes) should be done with the aim of producing
not only fibers, but also plastics. Among heat-resistant polymers of this
class polytetrafluoroethylene is of particular interest. Epoxy resins
will soon occupy an important place among plastics.

Polyurethane resins are being introduced into practical application
in different fields of technology, particular as adhesives. Diisocyanates,
on being reacted with polyesters, from polyester urethanes which can be ob-
tained in the form of films stable to the action of solvents, rubberlike
materials, porous materials, etc. They are of the greatest importance for
the production of adhesives and of films for the insulation of conductors
of electric current.

Development of new polymers with a high heat resistance is of the
greatest importance. The synthesis of carbon-carbon polymers containing
phenyl nuclei is important. Of the greatest interest from this standpoint
are investigations of mechanisms for the conversion of aromatic hydrocar-
bons such as benzene, p-xylene, and biphenyl into polymers with a linear or
cross-linked structure (e.g., polyphenylene, polyparaxylylene). Problems
pertaining to the control of reactions in such a manner that only linear
or cross-linked and three-dimensional polymers of this type are formed is
of exceptional importance and requires the organization of extensive re-
search carried out by chemists and physicist.

Research must be expanded in the field of the synthesis of organic
polymers containing fluorine (e.g., polyperfluorobutadiene, polyperfluoro-
benzene). New monomers for the synthesis of plastics containing fluorine
should be synthesized.

Although the impression arose originally that even linear polymers
containing inorganic atoms consisting of silicon and oxygen will have a
low elasticity, it was soon established that polymers of this type com-
posed of linear molecules are not inferior to purely organic polymers as
far as elasticity is concerned and furthermore are superior to the latter

with regard to heat resistance and a number of other characteristics. The possibilities of this interesting class of polymers have not been exhausted by far: further work must be done in this field on the synthesis of new polymers containing various organic radicals attached to the silicon atoms.

A very promising line of research in the chemistry of organosilicon polymers is the synthesis of high-molecular compounds that contain polar groups in the organic radicals directly bound to the silicon atoms. No less important is the development of methods for the conversion of monomers (after the correct monomers have been selected) into polymers with inorganic chains that contain polar groups in the radicals and have a correct distribution of these groups in the molecular chain.

A field which has not yet been investigated at all is that of block and graft polymers consisting of polyorganosiloxanes combined with each other or with organic polymers. Much can be done in this field, particularly if polymers containing polar groups in the organic radicals bound to the silicon atoms are used.

The transition from compounds with linear molecules to polymers with a branched chain or cross-linked chain molecular structure is simple. If the functional groups (e.g., alkoxy groups) at the silicon atoms are kept intact, these groups can serve as reaction centers for cross-linking polymer chains by joining silicon atoms over oxygen or as reactive groups for the formation of graft polymers.

An important step in the development of the chemistry of organosilicon polymers is the synthesis of polyorganmetalsiloxanes. The study of this extensive group of polymers is in the very beginning: methods for their preparation have not yet been developed to a great extent. Among methods for the synthesis of polyorganomethylsiloxanes, one should note the combined hydrolysis of alkyl-aryl-halogenosilanes with metal chlorides or metal alcoholates:

$$R_2SiCl_2 + MCl_3 \xrightarrow[\text{NaOH}]{\text{H}_2\text{O}} - OR_2Si - O - \underset{\underset{|}{\overset{|}{O}}}{M} - O - + 5 \text{ NaCl}$$
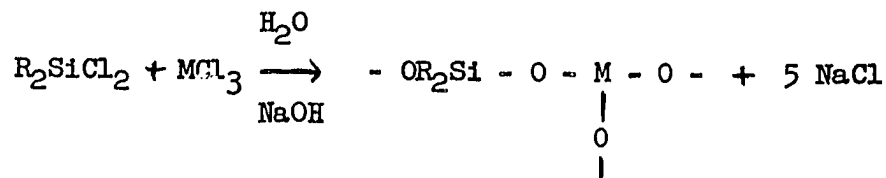
Another method is based on the double decomposition of the sodium salts of alkyl- and aryl-silane diols and triols with metal salts, as shown in the equation below, followed by the polycondensation of the resulting metal-silicon compounds to form linear or cross-linked macromolecules.

$$3 \text{ RSi}(OH)_2ONa + MCl_3 \longrightarrow [\text{RSi}(OH)_2O]_3M + 3 \text{ NaCl}$$

- 23 -
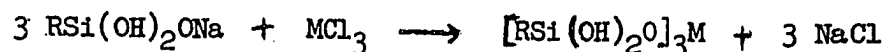
Methods of this type have been developed only for the introduction of metals of the following groups of the periodic system: III-aluminum, IV-titanium and tin, and VIII-nickel and cobalt.

Such elements as boron and antimony are introduced into the siloxane polymer chain with the aid of reactions of heterofunctional condensation, of which an example is given below:
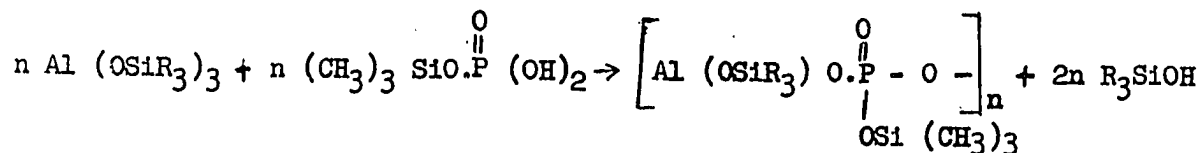
$$R_2Si\ (OR)_2 + C_6H_5B\ (OCOCH_3)_2 \longrightarrow CH_3COOR + RO\ SiR_2OBC_6H_5\ OCOCH_3.$$
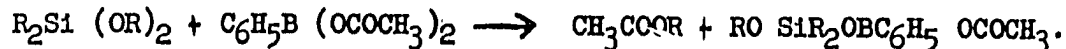
The development of methods for the preparation of polyorganometalsiloxanes with a linear structure of molecules presents considerable difficulties when elements of the III, IV, and V groups and particularly of the II group are involved. In connection with this, the possibility of surrounding the metals with $(R_3Si\ O-)$ organosiloxane groups is of interest. This procedure is of particular importance in the case of metals which do not form stable bonds with organic groups (e.g., aluminum, titanium, and iron). Of great importance is expansion of research on methods for the synthesis of new polyorganometalsiloxanes containing metals of the II and VI groups, and extension of the number of compounds of this class containing metals of the III, IV, and V groups.

It would be advisable to conduct research on the synthesis of polyorganometalsiloxanes with the molecular structure indicated below:

$$(R_3SiO)_2\ SiCl_2 + (R_3SiO)_2\ TiCl_2 + 2H_2O \longrightarrow -OSi(OSiR_3)_2OTi(OSiR_3)_2-O- + 4HCl.$$
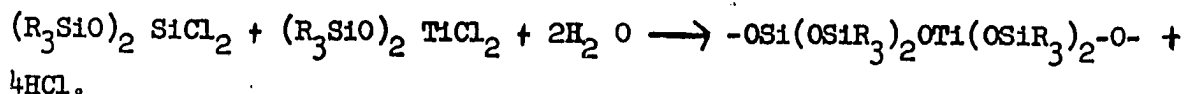
Of interest is the synthesis of polymers with inorganic principal chains and peripheral organosiloxane groups surrounding these chains. Polyorganosiloxanoalumoxanes of the type $-OAl\ (OSiR_3)\ OAl\ (OSiR_3)\ O-$ have not yet been investigated. Further work will undoubtedly lead to the synthesis of new polymers of this class. The use of polyfunctional compounds with mobile hydrogen atoms (for instance, trimethylsilylphosphoric acid) will make it possible to synthesize mixed polymers as illustrated by the following equation:

$$n\ Al\ (OSiR_3)_3 + n\ (CH_3)_3\ SiO.\overset{O}{\underset{}{\overset{\|}{P}}}\ (OH)_2 \rightarrow \left[Al\ (OSiR_3)\ O.\underset{\underset{OSi\ (CH_3)_3}{|}}{\overset{O}{\overset{\|}{P}}} - O - \right]_n + 2n\ R_3SiOH$$

Investigation of the properties of tetratrimethylsiloxytitanium has shown that as a result of the action of water this compound in the presence of catalysts undergoes chemical transformations which are accompanied by an increase in the viscosity of the solution. The product obtained, on

- 24 -

being spread on a solid surface, forms solid transparent films after evaporation of the solvent. Further investigation showed, that, as a result of the action of water on tetratrimethylsiloxytitanium in the presence of catalysts, products of the following type with different degrees of polymerization are formed:

$$(R_3SiO)_3 \ Ti \ [OTi \ (OSiR_3)_2] \ _x OTi \ (OSiR_3)_3.$$
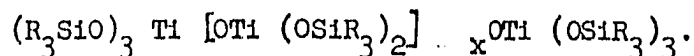
Polyorganosiloxytitanooxanes (which are soluble in toluene, cellosolve, ethyl acetal, and other solvents) can be obtained either with linear chain molecules or in the form of branched and three-dimensional molecules. These polymers have the following constitution:

$$- \ 0 \ - \ Ti \ (OSiR_3) \ 0 . Ti \ (OSiR_3) \ 0 \ -$$
$$\overset{|}{0}$$
$$- \ 0 \ - \ Ti \ (OSiR_3) \ - \ 0 \ -$$
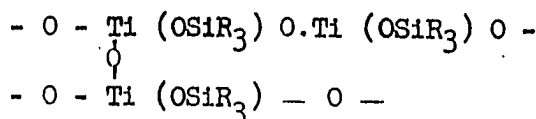
One of the ways of synthesizing polymers with partly organic and partly inorganic chains is the method of alternating in polymer chains aromatic groups with siloxane groups in a regular manner. In connection with this, it is very important to investigate the synthesis of polymers of the following structure:

$$n \ ClSiR_2 \bigcirc SiR_2Cl \xrightarrow{H_2O} 2n \ HCl + HO \ [\ -R_2Si \bigcirc SiR_2OSiR_2 \bigcirc SiR_2O]_x \ OH$$
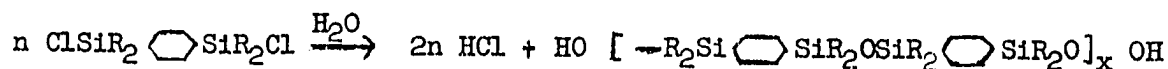
The ratio of siloxane groups to organic groups in the chain molecule can be varied within wide limits.

The ferrocenes investigated by A. N. Nesmeyanov and members of his group appear to be of interest for the synthesis of polymers with partly organic and partly inorganic chains. The chemistry of ferrocene derivatives is very extensive: among the compounds of this class which have been synthesized, many are of interest from the standpoint of the synthesis of polymers. As an example of the synthesis of polymers of this type, one may mention that substances with the following structure of chain molecules:
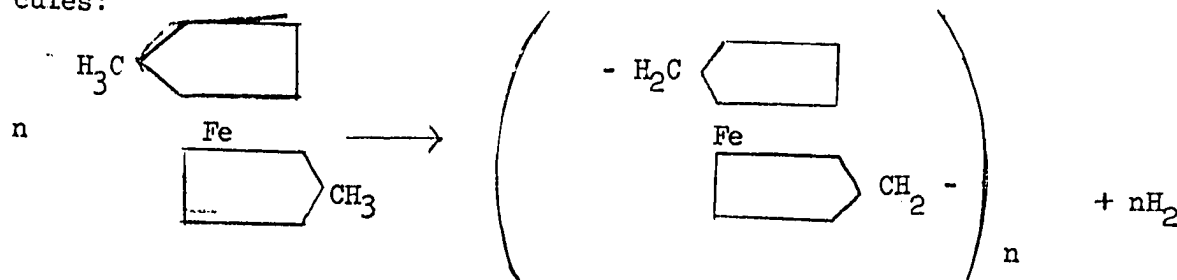
Organoelemental polymers containing inner-complex bonds can also be synthesized. In this particular field, one should investigate the reactions of diketones, which readily form with metals inner-complex compounds of the following structure:

$$-R-C\underset{CO}{\overset{CO}{\diagdown}}Fe\underset{OC}{\overset{OC}{\diagdown}}C-R-\ .$$
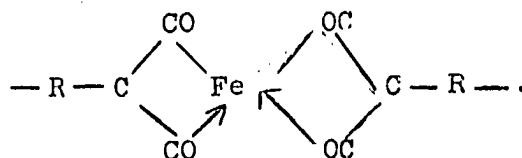
Work on the synthesis of the new polymers which have advantageous technical characteristics is of exceptional importance. The characteristics in question are mechanical strength, desirable electrical properties, and heat resistance. It is advisable to expand research on the synthesis both of new organic polymers and of polymers containing inorganic elements in the chains. The inorganic chains will endow the polymers with the properties of inorganic substances, while the radicals containing carbon which surround the inorganic chains will lend to the resulting polymers characteristics similar to those of organic high-molecular compounds. It is important to develop polymers which will narrow the cleft existing between properties of organic and inorganic polymers. Organic polymers, which have advantageous characteristics from the standpoint of elasticity and mechanical strength, lack resistance to heat, while inorganic polymers do not exhibit sufficient elasticity. The synthesis of easily produced polymers which exhibit the whole complex of technical characteristics required from the standpoint of the production of plastics and at the same time are derived from readily available new monomers is a very important task.

The problems involved can be best solved by employing phosphorus, aluminum, titanium, boron, tin, lead, cobalt, nickel, and other elements for the synthesis of polymers. In this manner the possibilities of the synthesis of polymers with inorganic chains, for instance, those of the silicon-oxygen-aluminum, silicon-oxygen-titanium, and silicon-carbon-oxygen-aluminum types, will be considerably expanded. Polymers of this type will resemble silicates as far as the structure of their molecular chains is concerned, but will contain purely organic or organosilicon peripheral groups surrounding these chains. Under the circumstances, the polymers to be synthesized will combine the properties of both classes of compounds, i.e., have the high heat resistance which is typical for silicates and the elasticity which is typical for the organic moiety of the molecules.

34. Formaldehyde as a Cross-Linking Agent for Sulfonated Polystyrene Resins

"Sulfonic Acid Ion-Exchange Resins on the Basis of Polystyrene and Formaldehyde," by A. A. Vasil'yev and A. A. Vansheydt, Institute of High-Molecular Compounds, Academy of Sciences USSR; Moscow, Zhurnal Prikladnoy Khimii, Vol 31, No 11, Nov 58, pp 1692-1697

A method is proposed for the synthesis of SSF ion-exchange resins based on sulfonation of polystyrene and subsequent action of formaldehyde on the soluble products of the sulfonation. The SSF cation-exchange resins are distinguished by a high exchange capacity (4.2-4.6 milligram equivalents per gram with coefficient of swelling equal to 2.4-3.2); they also have a good chemical and thermal stability and are produced from more accessible starting materials than cation-exchange resins derived from polystyrene and divinylbenzene.

35. A New USSR Periodical on High-Molecular Compounds

"Subscriptions Accepted for the Periodical Vysokomolekulyarnyye Soyedineniya To Be Published in 1959" [advertisement]; Moscow, Zhurnal Prikladnoy Khimii, Vol 31, No 11, Nov 58, p 1768

The periodical Vysokomolekulyarnyye Soyedineniya (High-Molecular Compounds) will be the principal organ of the Academy of Sciences USSR in the field of the chemistry and physics of polymers and monomers. The subject matter of the articles published in it will be concerned with general problems of the theory of high-molecular compounds that are of importance for the development of the production, treatment, and application of polymer materials.

The periodical will publish original theoretical research and results of experimental work on high-molecular compounds carried out at institutes and laboratories of the Academy of Sciences USSR, higher educational institutions, and industrial enterprises of the USSR. Both USSR and foreign scientists are invited to contribute to the periodical.

Vysokomolekulyarnyye Soyedineniya will serve the needs of scientific workers, aspirants, instructors at higher educational institutions, and workers active at scientific research institutes, laboratories, and industrial enterprises.

The subscription price for 12 issues to be published during the year is 150 rubles. The price of an individual issue is 12 rubles 50 kopecks.

The periodical will be published by "Akademkniga," Moscow, K-12, Ulitsa Kuybysheva (Kuybyshev Street) No 8.

- 27 -

36. USSR Conference on Geochemical and Radiometric Methods of Prospecting for Petroleum and Gas

"Information" (Report by V. Kozlov); Moscow, Geologiya Nefti, Vol 2, No 10, Oct 58, pp 70-72

A Conferenc· on Geochemical and Radiometric Methods of Prospecting for Petroleum and Gas Deposits was held in Moscow, 21-26 April 1958. This conference had been organized by the Academy of Sciences USSR. At the conference problems pertaining to the theory of gas investigation and of biochemical, hydrochemical, and radiometric methods of prospecting for and surveying petroleum and gas deposits were subjected to many-sided consideration. The present status of development of analytical equipment applied in geochemical and radiometric investigations and current trends in this field were also discussed. Workers at institutes of the Academy of Sciences USSR and its affiliates, the academies of sciences of union republics, institutes of the petroleum and gas industries, geological prospecting organizations of t}· sovnarkhozes, the State Plan of the USSR and the RSFSR, the State Committee on New Technology, and the Ministry of Geology and Conservation of Mineral Resources of the USSR participated in the conference. In addition, representative of countries of the People's Democracies participated in the conference. Twenty-seven reports were presented altogether, including seven reports by foreign scientists. Furthermore, a number of minor communications was made. About 70 participants at the conference took part in discussions.

The conference was opened by Academician D. I. Shcherbakov, secretary of the Department of Geologicogeographical sciences, who emphasized the priority of Russian scientists in the development of·geochemical methods, indicated some shortcomings in the application of these methods, and emphasized the necessity of more extensive application of methods of this type.

A report entitled "Migration of Elements and Geochemical Methods of Prospecting for Them" was made by A. A. Saukov, Corresponding Member, Academy of Sciences USSR. Prof V. A. Sokolov discussed the scientific basis of geochemical methods applied in prospecting for and surveying gas and petroleum deposits. He brought out that gases occurring in surface strata above coal deposits and free gases of such deposits as a rule do not contain a large quantity of the heavier $C_2 - C_4$ hydrocarbons. They are also completely free of gasoline vapors. This makes it possible to use the presence of absence of the gas components mentioned as a criterion in prospecting for petroleum.

- 28 -

Prof S. I. Kuznetsov stated that gaseous hydrocarbons are capable of being oxidized by many bacteria. On the basis of an extensive array of data, Kuznetsov demonstrated that bacteria which oxidize hydrocarbons are prevalent above petroleum and gas deposits.

G. A. Mogilevskiy reported on the present status of the investigation of the nature of [hydrocarbon] gas bacteria anomalies and suitable methods for the detection of such anomalies.

A report by B. P. Yasenev discussed results obtained with the aid of the method of gas surveying during the 15-year period of its application in the USSR and considered the efficiency of this method.

U. M. Yurovskiy reported on progress in gas core sampling in the USSR. He emphasized that, notwithstanding the difficult nature of the techniques involved, this type of testing is being applied extensively in the industry. The effectiveness of gas core sampling approaches 70 percent on the average at present. V. N. Kortsenshteyn told about the prevailing views in regard to the mechanism of the formation of gas occurrences in Stavropol'ye. I. A. Petersel'ye mentioned concrete instances of gas surveying and other geochemical work done on the Kola Peninsula. A. A. Geodekyan and G. A. Mogilevskiy reviewed geochemical investigations carried out abroad with particular attention to the US.

In a report entitled "Radiometric Procedures of Prospecting for Petroleum and Gas Deposits, Their Status of Development, and the Theory of This Method," Prof F. A. Alekseyev stated that lowered activities of the gamma field are typical for petroleum deposits. By carrying out radiometric measurements from the ground and from the air one can under conditions detect the presence of petroleum and gas deposits.

Two reports dealt with equipment for gas analysis: one by Prof V. A. Sokolov on gas-analytical methods and equipment (including methods and equipment for gas analysis at low temperatures, chromathermographic analysis, etc.) and one by Prof A. A. Zhukhovitskiy and N. M. Turkel'taub, Candidate of Chemical Sciences, on chromathermographic methods of gas analysis.

A paper by A. Ya. Krems, Doctor of Geologicomineralogical Sciences, G. G. Grigor'yev, and A. S. Medvedev reported on experience of many years acquired in the application of geochemical methods of prospecting for petroleum and gas in the region of the Timano-Pechorsk field.

Communications made by foreign participants at the conference were heard with great interest. Professor Schwartz (German Democratic Republic) confirmed on the basis of work done by himself the importance of determining very small quantities of hydrocarbons by the microbiological method. Prof S. Rasheyev (Rumania) dwelt on systematic investigations conducted in Rumania with the purpose of improving geochemical methods of prospecting.

As a result of this work, a highly sensitive device for the microanalysis of hydrocarbon gases was developed. A report by Prof A. Luchter (Poland) dealt with biochemical investigations. Papers presented by D. Bisira and I. Costescu (Rumania) were concerned with radiometric and geochemical methods of investigation. Y. Yuranek (Czechoslovakia) reported on work that was carried out at the Institute of Petroleum Research and dealt with geochemical methods and equipment for gas analysis. A report dealing with gas surveys and the detection of faults in Hungary as well as the nature of gas anomalies was contributed by Dr Stegena (Hungary). This report was read in the author's absence.

The discussions in connection with the reports were very animated and informative. Specifically, A. I. Kravtsov emphasized the necessity of the geochemical investigation of gases in coal basins; A. Ya. Krems again emphasized the great practical significance of the application of geochemical methods in the region of the Timano-Pechorsk field; and M. F. Dvali touched on some problems of the theory of geochemical methods. A. A. Amiroslanov, member of the Collegium of the Ministry of Geology and Conservation of Mineral Resources USSR and Corresponding Member of the Academy of Sciences USSR, emphasized the exceptional importance of the application of geochemical methods in prospecting for petroleum and gas. He invited the participants in the conference to expedite by every means the development of methods of this type and their extensive introduction into practical work.

A resolution was passed by the conference which stated that the effectiveness of prospecting for petroleum and gas can be greatly increased and the cost involved in this prospecting reduced if geochemical methods are used in the initial stage of prospecting and during later drilling for the purpose of structural exploration. The resolution also pointed out the inadequate nature of current theoretical research aimed at the improvement of geochemical methods and an increase in their efficiency. The work done by the All-Union Petroleum Scientific Research Institute for Geological Surveying (VNIGNI), the All-Union Scientific Research Institute of Geophysics, and the All-Union Scientific Research Institute of the Gas Industry (VNIIGAZ) during 1955-1958 in Northern Caucasus, Ukhta, and Kuybyshevskaya, Saratovskaya, and Stalingradskaya oblasts on the distribution of gas, bitumens, and microorganisms was briefly reviewed in the resolution. The resolution furthermore pointed out that, notwithstanding the scientific value of theoretical work and work on specific applications that has been done, research on the subject did not deal with all problems which should be solved. Notwithstanding the practical value of geochemical methods and the fact that surveying by the gas, hydrochemical, and microbiological methods yielded good results, some of the research work and field work was not of good quality. Optimum conditions exist for the application of each type of surveying mentioned above.

The conference regarded it as necessary to carry out the decisions of the preceding geochemical congresses (those held in 1952 and 1955), and of the Commission of the Academy of Sciences USSR concerned with geochemical prospecting, in regard to the practical application of gas analytical, bacteriological, and geochemical methods of surveying in regions where their applicability has already been demonstrated and on an experimental basis in a suitably modified manner (gas surveying in depth, gasometry of wells, etc.) in regions where investigation on the surface did not disclose the existence of any anomalies or indicated the presence of only weak anomalies.

The conference recommended many-sided application of geochemical methods in Siberia, Central Asia, and other regions where prospecting is being started.

To further the development and improvement of geochemical and radiometric methods, as well as their practical application, the conference recommended various organizational and technical measures, including organization of a special laboratory within the system of the Academy of Sciences USSR; organization by the Ministry of Geology and Conservation of Mineral Resources USSR of a division of geochemical methods at one of the institutes; organization of the industrial production of geochemical equipment by the State Plan of the USSR; training of specialists for geochemical work by the Ministry of Higher Education; testing for hydrocarbon gases, bitumens, and hydrocarbon bacteria in core samples removed from wells during drilling and investigations in regard to the presence of gas, salts, and microorganisms in wells drilled for water or in the course of exploring for water; and publication of a special periodical on problems of geochemical prospecting involved in the exploration of petroleum and gas deposits.

37. Separation and Purification of Substances by Means of Electrodialysis

"Analysis and Purification of Substances by Means of Novel Electrodialysis Procedures," by Academician V. A. Kargin, Prof R. P. Lastovskiy, and T. A. Matveyeva, All-Union Scientific Research Institute of Chemical Reagents; Moscow, Khimicheskaya Promyshlennost', No 5, Jul-Aug 58, pp 261-267

The subject is reviewed on the basis of USSR work. A bibliography consisting of five USSR references and one non-USSR reference is appended to the article. The methods and techniques used in this field are discussed in some detail. Several examples of the application of electrodialysis procedures are given. On the basis of the data presented, the following conclusions are made:

The method of high-voltage electrodialysis can be applied for the preparation of substances of high purity, including spectroanalytically pure substances; for the separation and concentration of valuable impurities present in small concentrations; for the purification of solutions from traces of electrolytes; and for the separation in a multichamber electrodialyzer of some mixtures of cations. Electrodialysis can be used extensively in practical analytical work to replace complicated and time-consuming chemical methods.

Inorganic Chemistry

[For information on inorganic chemistry, see Items No 26, 27, 29, and 30.]

Organic Chemistry

38. <u>Some New Organophosphorous Compounds Synthesized</u>

"The Synthesis of Certain Esters of Alpha-(Dialkylphosphon)-Beta, Beta, Beta-Trichloroethylphosphoric Acid and Alpha-(Dialkylphosphon)-Beta, Beta, Beta-Trichloroethyl Esters of Carboxylic Acids and Their Derivatives," by K. V. Nikonorov, Chemical Institute imeni A. Ye. Arbuzov, Kazan' Affiliate of the Academy of Sciences USSR; Moscow, <u>Izvestiya Akademii Nauk SSSR, Otdeleniye Khimicheskikh Nauk</u>, No 11, Nov 58, pp 1340-1344

Various esters of alpha-(dialkylphosphon)-beta, beta, beta-trichloroethylphosphoric acid, 12 [given in text] in all, were obtained by the interaction of the dimethyl and diethyl esters of alpha-oxy-beta, beta, beta-trichloroethylphosphinic acid with the acid chlorides of dialkylphosphoric acid in the presence of triethylamine.

Good yields of alpha-(dialkylphosphon)-beta, beta, beta-trichloroethyl esters of carboxylic acids and certain of their derivatives, 11 [given in text] in all, were obtained by the interaction of the dimethyl and diethyl esters of alpha-oxy-beta, beta, beta-trichloroethylphosphinic acid with acyl halides.

Preliminary investigations, conducted at the Kazan' Affiliate of the Academy of Sciences USSR by M. A. Kudrinaya, indicated that all the compounds obtained possess comparatively strong insecticidal properties. Investigations were conducted at the Scientific Institute for Fertilizers and Insectofungicides by Ye. A. Pokrovskiy to ascertain the systemic action of these compounds on certain types of biting insects.

39. Certain New Fluorine-Containing Analogs of Aldrin

"In the Field of Organic Insectofungicides, Report No XXXV, Concerning the Interaction of 1,1-Difluorotetrachloro-cyclopentadiene With Certain Unsaturated Compounds," by S. D. Volodkovich, N. N. Mel'nikov, A. F. Plate, and M. A. Pryani-shnikova; Moscow, Zhurnal Obshchey Khimii, No 11, Nov 58, pp 3123-3126

1,2,3,4,-Tetrachloro-10,10-difluoro-1,4,5,8-diendomethylene-1,4,4a,5,8,8a-hexahydronaphthalene and 1,2,3,4-tetrachloro-10,10-difluoro-1,4,5,8-. diendomethylene-1,4,4a,5,6,7,8,8a-octahydronaphthalene were synthesized by the interaction of 1,1-difluorotetrachlorocyclopentadiene with bicyclo-(2,2,1)-heptadiene-2,5 and bicyclo-(2,2,1)-heptene. In addition, the ad-ducts of 1,1-difluorotetrachlorocyclopentadiene were synthesized using cyclopentene, 5-amylbicyclo-(2,2,1)-heptene-2,5-methylbicyclo-(2,2,1)-heptene-2-carboxylic-5 acid, acrylonitrile, and esters of maleic acid.

A study of the insecticidal activity of the synthesized compounds, con-ducted by Ye. F. Granyn, indicated that almost all the compounds in this series were slightly active. The results indicated that 1,2,3,4-diendome-thylene-1,4,4a,5,8,8a-hexahydronaphthalene (difluoroaldrin) is slightly less active than chlorindane.

40. A New Method of Synthesizing 4-Aminopiperidine

"Synthesis of 4-Aminopiperidine," by L. N. Yakhontov, S. V. Yatsenko, and M. V. Rubtsov, All-Union Scientific Research Chemical Pharmaceutical Institute imeni S. Ordzhonikidze; Moscow Zhurnal Obshchey Khimii, No 11, Nov 58, pp 3115-3119

A comparative study of three methods of obtaining 4-amino-piperidine, a biologically active compound, by utilizing the Kirtsius, the Hofman, and the Shmidt reactions was conducted.

A preparative method of synthesizing 4-aminopiperidine from isonico-tinic acid in two stages with a 66% yield was developed.

The catalytic reduction of 4-aminopiridine to 4-amino-piperidine was accomplished.

During the course of the investigation N-formyl derivatives were also synthesized: 1-formylisonipecotic acid and 1-formyl-4-formyl-aminopiperidine.

41. Phenyl Esters of Alpha-oxyalkylphosphinic Acids

"Concerning the Interaction of Dialkylphosphorous Acids With Aldehydes and Ketones, Report No XVIII, Phenyl Esters of Alpha-oxyalkylphosphinic Acids," by V. S. Abramov and N. A. Semenova, Kazan' Chemical Technological Institute imeni S. M. Kirov; Moscow, Zhurnal Obshchey Khimii No 11, Nov 58, pp 3056-3058

It was shown that the condensation reactions of aldehydes and ketones with dialkylphosphorous acids can proceed as conjugate reactions simultaneously with the saponification of phosphites. Twelve phenylic esters of various alpha-oxyalkylphosphinic acids were obtained [given in text].

42. Esters of Alpha-oxyalkylphenylphosphinic Acids

"Concerning the Interaction of Aryl(alkyl)phosphinic Acids With Aldehydes and Ketones, Report No XIX, Esters of Alpha-oxyalkylphenylphosphinic Acids," by V. S. Abramov and M. I. Kashirskiy, Kazan Chemical Technological Institute imeni S. M. Kirov; Moscow, Zhurnal Obshchey Khimii, No 11, Nov 58, pp 3059-3061

It was shown that the acid esters of phenylphosphinic acid react with aldehydes and ketones forming the esters of alpha-oxyalkylphenylphosphinic acids. The condensation reaction proceeds without a catalyst; the aldehyde reactions proceeded with the evolution of a certain amount of heat.

Eleven esters [given in text] of various alpha-oxyalkylphenylphosphinic acids were synthesized.

43. Some Phosphinic Acid Reactions

"The Interaction of Sulfur and Inorganic Sulfides With Complex Compounds of Dialkyltrichlorophosphines and Aluminum Chloride," by S. Z. Ivin and K. V. Karabanov; Moscow, Zhurnal Obshchey Khimii, No 11, Nov 58, pp 2958-2960

Certain complex compounds resulting from the interaction of dialkyltrichlorophosphines and aluminum chloride were obtained and characterized.

It was shown that the interaction of sulfur and inorganic sulfides with dialkyltrichlorophosphine complexes and aluminum chloride in the presence of potassium chloride leads to the formation of acid chlorides of dialkylthiophosphinic acids; at the same time, a new method for synthesizing acid chlorides of dialkylphosphinic acid was discovered.

- 34 -

The Interaction of Sulfur and Inorganic Sulfides With Complex Compounds of Alkyltetrachlorophosphines and Aluminum Chloride," by I. P. Kompkov, S. Z. Ivin, and K. V. Karabanov; Moscow, Zhurnal Obshchey Khimii, No 11, Nov 58 pp 2960-2962

The interaction of sulfur and inorganic sulfides with complex compounds of alkyltetrachlorophosphines and aluminum chloride was studied and it was shown that dichloroanhydrides of alkylthiophosphinic acid are formed by this interaction.

The interaction of antimony sulfide or phosphorus sulfide with complex trichloromethyltetrachlorophosphine compounds and aluminum chloride in the presence of potassium chloride leads to the decomposition of the complex and the formation of carbon bisulfide and thiochlorine oxides of phosphorus.

"New Methods of Obtaining Alkyldichlorophosphines and Dialkylchlorophosphines," by I. P. Komkov, K. V. Karabanov, and S. Z. Ivin, Moscow; Zhurnal Obshchey Khimii, No 11, Nov 58, pp 2963-2965

A new method of synthesizing alkyldichlorophosphines was developed by reducing complex alkyltetrachlorophosphine compounds and aluminum chloride with the aid of metallic aluminum, red phosphorus, and metallic sodium. Methyldichlorophosphine, never described previously in the literature, was obtained.

A new method for obtaining dialkylchlorophosphines was discovered. The method is based on the interaction of complex dialkyltrichlorophosphine compounds and aluminum chloride with metallic aluminum.

The addition of sulfur to dimethyl-, methylethyl-, and diethylchlorophosphines was accomplished and the corresponding compounds isolated, one of which, the acid chloride of dimethylthiophosphinic acid, has never been described in the literature.
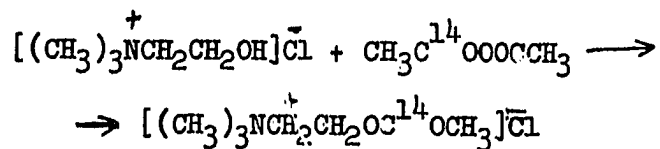
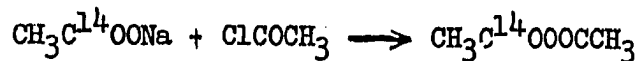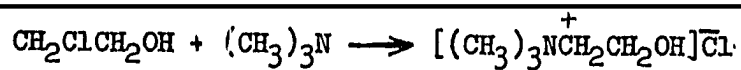44. Acetylcholine Synthesis

"Synthesis of Acetylcholine Tagged With Radioactive Carbon C^{14} in the Complex Ester Group," by L. B. Dashkevich and V. S. Karpinskiy, Leningrad Chemicopharmaceutical Institute; Moscow, Zhurnal Obshchey Khimii, No 11, Nov 58, pp 3011-3012

Choline was synthesized from ethylene chlorohydrin and trimethylamine which permitted a product yield of 65% of the theoretical.

- 35 -

The synthesis of acetylcholine hydrochloride tagged with radioactive carbon C^{14} in the complex ester group was accomplished by the acetylation of choline hydrochloride by a radioactive preparation of acetic anhydride.

The reaction is given as follows:

CPYRGHT

$$CH_2ClCH_2OH + (CH_3)_3N \longrightarrow [(CH_3)_3\overset{+}{N}CH_2CH_2OH]\overset{-}{C}l$$

$$CH_3C^{14}OONa + ClCOCH_3 \longrightarrow CH_3C^{14}OOOCCH_3$$

$$[(CH_3)_3\overset{+}{N}CH_2CH_2OH]\overset{-}{C}l + CH_3C^{14}OOOCCH_3 \longrightarrow$$

$$\longrightarrow [(CH_3)_3\overset{+}{N}CH_2CH_2OC^{14}OCH_3]\overset{-}{C}l$$

45. <u>Organophosphorus Research</u>

"Action of Methyl Esters of 1,2-Dibromo- and 1,2-Dichloro-propionic Acid on Trialkylphosphites and the Na-derivatives of Diethylphosphoric Acid," by Gil'm Kamay and V. A. Kukhtin, <u>Tr. Kazansk. Khim. Tekhnol. In-ta</u> (Works of the Kazan Chemical Technological Institute), 1956, No 21, 141-146 (from <u>Referativnyy Zhurnal -- Khimiya,</u> No 18, 25 Sep 58, Abstract No 61029 by Ya. Komissarov)

CPYRGHT

"On reacting $BrCH_2CHBrCOOCH_3$ with $(RO)_3P$ or $(C_2H_5O)_2PONa$ (1), it was not possible to separate the individual products; in the latter case, it appears, $CH_2=C(COOCH_3)P(O)(OC_2H_5)_2$ is formed. However, by reacting $ClCH_2-CHClCOOCH_3$ (2) with (1), $(C_2H_5O)_2P(O)CH(COOCH_3)CH_2P(O)(OC_2H_5)_2$ (3) is readily formed. The interaction of (2) with $(RO)_3P$ leads chiefly to the formation of $ClCH_2CH(COOCH_3)P(O)(OR)_2$ (4) with admixtures of type (3) substances; at 140-170°C the polymer $CH_2=CClCOOCH_3$ is formed. To an ether solution of (1) (from $(C_2H_5O)_2POH$ and Na), (2) was gradually added while cooling the solution; (3) was separated: boiling point 162-163° at 3 mm, $n^{20}D$ 1.4474, and d_0^{20} 1.1809. Then 50 g of $(CH_3O)_3P$ and 65 g of (2) were heated; the mixture was heated at 100° for 30 minutes to 122°, 20.3 g of CH_3Cl were driven off, and 10 g of (4) were produced (where R= CH_3): boiling point 106-108° at 2 mm, $n^{20}D$ 1.4555 and d_0^{20} 1.2691. Analogously, (4) (where R= C_2H_5) was obtained, a yield of 10 g (from 30 g of $(C_2H_5O)_3P$ and 30 g of (2)): boiling point 131-132° at 4 mm, $n^{20}D$ 1.4460 and d_0^{20} 1.1670."

"Cyano-substituted Esters of Phosphoric Acid. Report 1. Tri-alpha-cyanoisopropylphosphite and Several of Its Properties," by E. V. Kuznetsov and P. K. Valetdinov. <u>Tr. Kazansk. Khim. Tekhnol. In-ta</u> (Works of the Kazan Chemical Technological Institute), 1956, No 21, 167-169 (from <u>Referativnyy Zhurnal -- Khimiya,</u> No 18, 25 Sep 58, Abstract No 61030, by Ya. Komissarov)

CPYRGHT

"By reacting PCl_3 with $(CH_3)_2C(OH)CN$ (1), $P(OC(CH_3)_2CN)_3$ (2) was easily formed (cf. Chrzaszewska, Sobieranski, Roczniki chem., 1927, 7, 470); it does not isomerize any further, even under prolonged heating. To 0.5

moles of PCl_3 (70°) 1.5 moles of (1) are gradually added; the mixture is heated for one hour at 60-70°; the yield of (2) is 86%: boiling point 153-154° at 4 mm; $n^{20}D$ 1.4468 and d_4^{20} 1.0749. By passing O_2 through (2) at 78°, $OP(OC(CH_3)_2CN)_3$ is formed; yield 90%, boiling point 145-146° at 0.6 mm and 177-178° at 4 mm, $n^{20}D$ 1.4295, and d_4^{20} 1.1150. A mixture of 22.5 g of (2) and 27 g of $PSCl_3$ was heated to 120-130°; after extracting the PCl_3, $SP(OC(CH_3)_2CN)_3$ was obtained: boiling point 81°."

46. Results of a Previously Reported Phosgene Reaction Not Corroborated

"The Reaction of Trialkylphosphites With Phosgene," by M. I. Kabachnik and P. A. Nossiyskaya, Institute of Elementoorganic Compounds, Academy of Sciences USSR; Moscow, Izvestiya Akademii Nauk SSSR, Otdeleniye Khimicheskikh Nauk, No 11, Nov 58, p 1398

The authors state that they were unable to confirm a reaction they reported in 1957 in a paper entitled "The Reaction of Chloroacetyl Chloride, Trichloroacetyl Chloride, and Phosgene With Trialkylphosphites," in which it was stated that chloroformylphosphinic esters $ClCOPO(OCH_3)_2$ are formed by reacting phosgene with trialkylphosphites. The authors explain that in repeating this reaction, where phosgene was reacted with trimethylphosphite, dimethylchlorophosphate was formed with the evolution of carbon monoxide:

$$COCl_2 + P(OCH_3)_3 \rightarrow CH_3Cl + CO + ClPO(OCH_3)_2$$
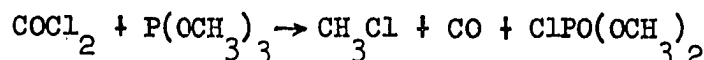
Furthermore, since the chloroformylphosphinic ester was not obtained, as far as it is known, the products resulting from its conversion, as presented in the original paper, do not correspond to the formula given and their nature remains unclear.

47. The Nitration of 2.3-Dibromopropylene

"On the Nitration of 2,3-Dibromopropylene," by A. D. Nikolayeva, E. V. Red'kina, and Gil'm Kamai, Tr. Kazansk. Khim. Tekhnol. In-ta (Works of the Kazan Chemical Technological Institute), 1957, No 23, 243-246 (from Referativnyy Zhurnal -- Khimiya, No 18, 25 Sep 58, Abstract 60878, by V. Rudenko)

"On nitrating 2.3-dibromopropylene-1 (1) with concentrated HNO_3 containing 7-10% nitric oxide at 45-48° C, the following products were obtained: 1,2-dibromo-1,1-dinitroethane (2), 1-bromo-2,-2-

CPYRGHT

dinitroethane (3), and alpha, beta-dibromo-alpha-nitropropionic acid (4). By the gradual treatment of (4) with concentrated HNO_3 and a mixture of H_2SO_4 and HNO_3, (2) was obtained. The probable scheme of the reaction was adduced. To a mixture of 200 ml of concentrated HNO_3 and 500 ml of dichloroethane at 30°, 20 g of (1) was added; it was heated for 40-50 minutes; at 45-48° 200 ml of H_2SO_4 (d, 1.83) were added after one hour at 45-50°,

(3) was obtained: boiling point 42-43° at 12 mm, $n^{20}D$ 1.4940, and d_4^{20} 1.8517; and (2): boiling point 48° at 1 mm, d_4^{20} 2.0922. From the residue, (4) was obtained: boiling point 46° (from dichloroethane), which severely burns the skin."

48. Review of Arsenic Refractometric Values

"On the Quantitative Modification of the Atomic Refraction Value of Arsenic in Organoarsenic Compounds," by Gil'm Kamai and I. M. Starshov, Tr. Kazansk. Khim. Tekhnol. In-ta (Works of the Kazan Chemical Technological Institute), 1957, No 23, 111-121 (from Referativnyy Zhurnal -- Khimiya, No 18, 25 Sep 58, Abstract No 59936, by S. Batsanov)

CPYRGHT

"Domestic data and data recorded in the literature since 1922 on the refractometry of organoarsenic compounds were reviewed and analyzed. It was demonstrated that the atomic refractions of trivalent arsenic were less than those of pentavalent arsenic; however, the refraction of arsenic remained constant within the one class of compounds. The refraction of arsenic in alkyl tertiary arsines was exactly 11.6-11.8 cm^3; in complete esters of arsenous acid it was 9.5-9.6 cm^3; in intermediate cases it varied according to the additive rule between the indicated class limits. It was established further that when an aryl group is present instead of an alkyl group there is an increase of 0.7 cm^3 in refraction; however, if a cyclic ester grouping is present instead of two alkoxy groups there is a 0.7 cm^3 decrease. By employing the indicated corrections it is possible to arrive at an exact calculation of the molecular refractions of the organoarsenic compounds and possibly of other elementoorganic compounds."

- 39 -

Pesticides

49. Rodenticidal Properties of Thiosemicarbazide

"Thiosemicarbazide and Its Rodenticidal Properties," by A. A. Paseshnik, Tr. Tsentr. N. I. Dezinfekts. In-ta (Works of the Central Scientific Research Disinfection Institute), 1957, No 10, 287-290 (from Referativnyy Zhurnal -- Khimiya, No 18, 25 Sep 58, Abstract No 62018 by I. Mil'shteyn)

"The use of thiosemicarbazide (1) as a rodenticide was studied. The lethal dose (LD) for various animals is given as follows (LD in mg/kg): gray rats, 12; house mice, one; gray mice, 3-4; spotted and small susliks, 5; rabbits, 30-40; chickens, 50-60. The appearance of resistance to (1) in gray rats was established by these tests. Resistance develops after receiving 1-2 mg of (1) for a period of 14 days; gray rats which are resistant to zinc phosphide are also resistant to (1); but resistance to (1) disappears after 2 months. To eliminate rodents, the use of (1) in the form of a 5% feed bait is recommended."

50. Tick Repellants

"Test of the Use of Tick Repellant Substances in the Focus of the Spring-Summer Tick Encephalitis," by S. G. Gladkikh, Tr. Tsentr. N.-I Dezinfekts. In-ta (Works of the Central Scientific Research Disinfection Institute), 1957, No 10, 234-239 (from Referativnyy Zhurnal -- Khimiya, No 19, 10 Oct 58, Abstract No 65440, by I. Mil'shteyn)

Dimethyl-, diethyl-, and dibutylphthalate appear to be effective repellants against Ixodes persulcatus; the duration of the repelling activity of the preparations was 10, 15, and 20 days respectively (at a rate of 30-50 g per suit or overalls). Continuous treatment of clothing appears to be more reliable than the barrier method.

51. The Use of Hexachlorocyclohexane in Aerial Dusting

"Aerial Dusting With Hexachlorane -- Effective Method of Controlling the Butterfly of the Meadow Moth," by S. I. Isaev, Sb. Nauchno-issled. rabot Azovo-Chernomorsk. S.-kh. In-ta (Collection of the Scientific Research Works of the Azov-Chernomorsk Agricultural Institute], 1957, 15, 245-247 (from Referativnyy Zhurnal -- Khimiya, No 19, 10 Oct 58, Abstract No 65423, by I. Mil'shteyn)

For controlling the butterflies of the meadow moth, Loxostege stieticalis Li., good results were obtained by aerial dusting with 12% dust of hexachlorocyclohexane; optimum rate of dust delivery was 20 kg per hectare.

Physical Chemistry

52. Ignition of Adiabatically Heated Gas Mixtures

"On the Problem of the Ignition of an Adiabatically Heated Gas Mixture" by S. G. Zaytsev and R. I. Solukhin, Power Institute imeni G. M. Krzhizhanovskiy, Academy of Sciences USSR; Moscow, Doklady Akademii Nauk SSSR, Vol 122, No 6, Oct 58, pp 1039-1041

In work done hitherto on the ignition of homogenous gas mixtures subjected to rapid adiabatic heating, it was established that there is a finite induction period and that foci of ignition form during the initial stage of the process. A detailed investigation of the formation and development of ignition foci could not be carried out because of the insufficient resolving capacity of the recording equipment. Using improved equipment, the origin and development of the exothermic reaction taking place in a hydrogen-oxygen mixture heated adiabatically to temperatures in the range of 600-1,400° at pressures of 1-3 atmospheres were investigated. The method applied, which involved recording by schlieren-photography with the aid of an IAB-451 apparatus and measurement of pressures by means of a piezoelectric appliance, is described in detail.

It was established that the visible reaction, which is accompanied by intense emission of light and abrupt changes in the thermodynamic parameters of the gas mixture, originates in one or several points forming reaction centers. The volume of gas in which the reaction takes place grows around the centers until several centers merge, forming a region in which a shock explosion originates. The velocity of the propagation of the front of a newly formed region of this type goes up to 2,000 meters per second.

It is assumed that the concentration of active intermediate products in the gas increases as a result of the heating. After termination of the induction period, there is a precipitate acceleration of the reaction at points where the reaction centers are formed. Further development of the reaction proceeds by normal propagation of flame fronts. In view of the fact that a number of ignition foci always arise in an adiabatically heated mixture, parts of the gas volume ignite in regions surrounded from all sides by combustion fronts. This leads to local explosions accompanied by the formation of shock explosions (which are observed experimentally) in the combustion products. The shock explosions, on reaching gas which has not yet ignited, form fronts of detonation combustion.

53. Reinforcement of Shock Waves as a Result of Interaction With the
Flame Front

"Interaction of Shock Waves With the Flame Front," by S. M.
Kogarko, V. I. Skobelkin, and A. N. Kazakov, Institute of Chem-
ical Physics, Academy of Sciences USSR; Moscow, Doklady Akademii
Nauk SSSR, Vol 122, No 6, 21 Oct 58, pp 1046-1048

The problem in regard to the reinforcement of shock waves as a result
of their interaction with the flame front is subjected to mathematical
treatment. It is concluded that the total reinforcement of shock waves is
determined by a relaxation process (cf. S. M. Kogarko and V. I. Skobelkin,
Doklady Akademii Nauk SSSR, Vol 120, No 6, 1958) and by a finite change in
the normal velocity of flame propagation in the shock wave after relaxation.
The relaxation reinforcement is of primary importance when the wave is weak.

Radiation Chemistry

54. Formation of Hydrogen Peroxide in Aqueous Solutions of Sulfuric Acid
as a Result of the Action of Alpha Radiation

"The Action of Alpha Radiation on Aqueous Solutions of Acids,"
by Z. V. Yershova and M. V. Vladimirova; Moscow, Atomnaya Ener-
giya, Vol 5, No 5, Nov 58, pp 546-549

The action of the alpha radiation emitted by polonium on an 0.8 N ε-
aqueous solution of sulfuric acid was investigated. It was established that
within a wide range of concentrations of dissolved polonium (0.1-12 milli-
curies per milliliter) the initial radiation-chemical yield of hydrogen
peroxide remains the same and equals 1.20 molecules per 100 electron volts
of absorbed energy and that the concentration of hydrogen peroxide ap-
proaches a limit. The limiting (equilibrium) concentration of hydrogen
peroxide in 0.8 N sulfuric acid comprises approximately 5-8 x 10^{18} mole-
cules per milliliter.

Radiochemistry

55. Experiments on the Use of Radioactive Tracers to Indicate Boundaries Between Difference Petroleum Products Pumped Through the Same Pipeline

"Concerning the Control With the Aid of Radioactive Isotopes of Successive Pumping of Petroleum Crudes and Petroleum Products," by V. Z. Votlokhin and I. Kh. Khizgilov, Groznyy Petroleum Scientific Research Institute and Moscow Institute of the Petrochemical and Gas Industries imeni Academician I. M. Gubkin; Baku, Izvestiya Vysshikh Uchebnykh Zavedeniy-Neft' i Gaz, No 10, Oct 58, pp 99-102

In 1956-1957 the Groznyy Petroleum Scientific Research Institute conducted investigations on the use of radioactive tracers to control the successive pumping of different petroleum products through the same pipeline. Model experiments that were made on the successive pumping of water and an 8% solution of sodium chloride in a closed circuit are described. Co^{60} in the form of an aqueous solution of $CoCl_2$ was used as the tracer to indicate the boundary between the two liquids. The results obtained indicate that the radiometric method makes it possible to carry out continous control without contact with the liquid and that this method is more precise than the methods used hitherto (the precision in determining boundaries is 10-15% greater than with the specific gravity method).

Miscellaneous

56. Mikhail Mikhailovich Shemyakin Elected to Academy of Sciences USSR

"Elections of Academicians and Corresponding Members to the Academy of Sciences USSR" (unsigned article); Moscow, Izvestiya Akademiya Nauk SSSR, Otdeleniye Khimicheskikh Nauk, No 9, Sep 58, p 1149

Mikhail Mikhailovich Shemyakin was elected a member of the Academy of Sciences USSR during the elections held 16-20 June 1958. He is 50 years old.

"Mikhail Mikhailovich Shemyakin is one of the foremost Soviet organic chemists, known for his work in the chemistry of natural and biologically active compounds and for his work in theoretical organic chemistry and biochemistry. For the last 10 years, Shemyakin has performed particulary extensive research in the chemistry and biochemistry of antibiotics. In this field, he has made a series of important discoveries concerning the chemistry of the valuable antibiotic, chloromycetin, the synthesis of which was first accomplished in his laboratory, as well as the production

CPYRGHT

of its racemate, synthomycin, and the antibiotic, levomycetin. Shemyakin developed various methods of synthesis and produced numerous analogs of chloromycetin. Later research led him to establish a number of important relationships between the structure and the antibiotic activity of this group of compounds and to study the initial stages of the mechanism of action of chloromycetin. These works first established the prerequisites for directed research on the highly active analogs of chloromycetin. Major results were also obtained by Shemyakin's research on the chemistry of the important tetracyclic antibiotics -- aureomycin (biomycin), terramycin, and others. He resolved unexplained questions about their structure, and in more recent times, developed the fundamental processes for synthesizing these complex compounds. Shemyakin recently accomplished the synthesis of an anticancer antibiotic, sarcomycin; he also studied the structure, properties, and problems of biogenesis of a series of other antibiotics -- streptomycin, patulin, allicin, and others. The contemporary status of antibiotic chemistry has been exhaustively covered in his basic monograph Chemistry of Antibiotic Substances which is now in its second edition.

"Extensive investigations were performed by Shemyakin on the chemistry and biochemistry of vitamins. He developed and introduced into production a simple method of synthesizing a blood-coagulating substance, vitamin K_3, and its bisulfite derivative. Theoretical research involving the vitamins of the B_6 group was conducted during 1952-53 by Shemyakin and A. E. Braunshteyn which led to a very important general principle of biochemistry -- the creation of the theory for the processes of amino acid exchange, catalyzable by phosphopyridoxalevo enzymes. This theory permitted, from one point of view, an explanation of the nature of numerous types of biochemical processes. During the past several years, Shemyakin has been conducting a series of important investigations on the chemistry of amino acids and peptides. He has discovered a general method of synthesizing gamma-substituted, alpha-amino acids; and studied their properties and found ways of introducing them into peptides; he has developed general methods of synthesizing many amino acids, tagged with C^{14} and N^{15}, which have now been released for biological research.

"The numerous theoretical works of M. M. Shemyakin have been devoted to a study of the character and mechanism of a series of chemical reactions. For more than 20 years he has done work on the oxidizing-hydrolytic conversion of organic compounds, leading to important theoretical generalizations. Over 140 scientific works have been published by Mikhail Mikhailovich Shemyakin."

57. <u>Planning Institute of Chemistry Established in Armenian SSR</u>

"Future Major Chemical Growth," by E. Akopyan, deputy chief, Administration of Chemical Industry, Armenian Sovnarkhoz; Yerevan, <u>Kommunist</u>, 9 Oct 58

According to a decision of the May Plenum of the Central Committee, Communist Party Armenia, a new Scientific Research Planning Institute of Chemistry (Nauchno-Issledovatel'skiy Proyektnyy Institut Khimii) will be established in Kirovakan, Armenian SSR. The institute is scheduled to work on the solution of important problems in the chemical industry of the republic.

58. <u>Department of Chemical and Geological Sciences Formed at Academy of Sciences Latvian SSR</u>

"Throughout the USSR" (unsigned article); Moscow, <u>Trud</u>, 7 Oct 58

The Academy of Sciences Latvian SSR has recently formed a Department of Chemical and Geological Sciences. The new department will have under its jurisdiction the following institutes: Institute of Chemistry, Institute of Organic Synthesis, Institute of Forestry Problems and Chemistry of Wood Pulp, and the Institute of Geology and Mineral Resources.

Through the establishment of this department, the academy expects to expand its research in chemistry. At the same time the Presidium of the Academy of Sciences Latvian SSR has approved the editorial staff of its new periodical, <u>Latviyskiy Khimischeskiy Zhurnal</u> (Latvian Chemical Journal), which will be published bimonthly.

III. ELECTRONICS

Communications

59. Transistor TV Receivers

"Television Receiver Built With Semiconductor Devices," by Ye.
Gershzon and V. Kol'tsov; Moscow, Radio, No 11, Nov 58, pp 23-26

The article describes the basic units of a laboratory model of a
transistor TV receiver designed at the Moscow television affiliate labora-
tory. The only vacuum unit incorporated in the receiver is the kinescope
picture tube type 18LK5B. The set contains 30 transistors, 8 germanium
diodes, and 10 type ABC-5-1a selenium piles. The receiver is built on
the superheterodyne principle and is designed to receive TV programs in
the frequency range of 49.75 — 56.26 Mc. The power supply can be drawn
from a 12-v storage battery. The power consumption is about 1.1 a.
Sensitivity of the set is about 200 microvolts at the level of circuit
noises of 20 db. For the input voltage of about 400 microvolts the circuit
noises are practically absent. Audio power output is 0.7w. The screen
dimension is 142 x 107 mm; the over-all dimensions of the set are 200 x 200 x
250 mm; the weight is 7 kg. The RF amplifier and mixer unit incorporate
type P403 diffused-junction transistors with upper frequency limit of
100 Mc. The IF unit incorporates type P402 transistors with upper frequency
limit of 60 Mc. Amplification frequency range is 27-75 — 34.25 Mc. Ger-
manium diode DG-Ts4 is used as video detector and P402 transistors are
used as video amplifiers. The audio frequency amplifier uses P401 and P201
transistors. The blocking oscillator is built with P2B transistors. The
vertical sweep unit incorporates P2B and P-201 type transistors.

60. UHF Communication in USSR

"41st Anniversary of Great October" (unsigned article); Moscow,
Radio, No 11, Nov 58, pp 1-2

CPYRGHT The article contains the following passage:

"The party and government directives to expand the work of introducing
UHF broadcasting are being realized. Last year, 22 UHF (ultrashort wave)
transmitters were in operation. At present their number has increased.
UHF-FM radio stations are operating in Minsk, Sverdlovsk, Baku, Klaypede,
Stalino, Tiblisi, Tashkent, and many other places in the country. The
planned industrial-scale production of a new, economical, fully automatic
radio station, operating without servicing personnel and which can be
switched on at a distance up to 10 km, will permit introduction of multi-
program UHF broadcasting in densely populated regions of the nation."

- 46 -

61. Moscow Television Tower of Prestressed Concrete

"Television Tower of Prestressed Concrete" (unsigned article); Budapest, Muszaki Elet, 16 Oct 58, Vol 13, No 21, p 5

We have already reported in our columns concerning the new 500-meter-tall television tower being built southwest of Moscow. More recent news on it reports that the 500-meter tower is being built of prestressed concrete instead of the steel structure generally used abroad. The new solution means a significant development from a structural as well as from an aesthetic viewpoint. The four elevators in the tower will be able to carry 56 persons at a time to the observation area being built at the 400-416-meter level. A small restaurant is also being built in the observation area; the observation area can hold 1,000 persons at a time. In case of maximum wind velocity the tower will have an oscillation of 4 meters, but due to the large oscillation time (12-13 seconds) this will be hardly noticeable. The wall thickness of the tower is 25 centimeters. Its diameter is 7 meters at the top and 20 meters at the bottom and it stands on a four-leg base having a diameter of 65 meters. The iron rods providing the pre-stress effect are being placed in the interior of the tower outside the walls. The some 4,000 rods are stressed with a force of 9,000 tons. The work will be left uncovered for 1-2 years, until the curing of the concrete is completed, and then it will be covered with "torkret" (sprayed) concrete. With the use of movable forms, construction of the tower will be completed in one year and the installation of equipment in 2 years.

Wave Propagation

62. Radio Wave Propagation in Tropospheric Duct

"Propagation of Radio Waves in a Tropospheric Duct Over the Earth's Surface," by V. A. Fok, L. A. Veynshteyn, and M. G. Belkina; Moscow, Radiotekhnika i Elektronika, No 12, Dec 58, pp 1411-1429

Mathematical methods were derived which permit calculating radio wave propagation in the inverse tropospheric layer, i.e., the tropospheric duct. With the aid of this method a series of specific cases of propagation along a tropospheric duct were calculated. On the basis of the results thus obtained it was possible to compare the superdistant propagation of radio waves of various length. On the basis of the over-all results it is concluded that the superdistant (in a duct) propagation is subject to slow attenuation with increase of wave length.

The criterion for the existence or absence of conditions favorable to superdistant propagation depends on the properties of the inversion layer and the wave length.

- 47 -

63. Radio Wave Scattering on Tropospheric Inhomogeneities

"Study of Radio Wave Scattering on Tropospheric Inhomogeneities of the Refractive Index by Means of Radioastronomical Measurements," by M. A. Yevdakimov; Moscow, Radiotekhnika i Elektronika, No 12, Dec 58, pp 1430-1440

The intensity of scattered radio wave radiation from the sun traversing an inhomogeneous troposphere was investigated. Utilizing the sun's radio wave radiation to study the scattering effect has both advantages and disadvantages. The measurements were conducted on 3.2 cm wave length with the aid of a polarized radiometer of 1-5° sensitivity, which corresponds to a power sensitivity of 10^{-16} w.

With the aid of this radiometer it was possible to measure intensity as well as direction and degree of polarization of the radio wave. Since this work was concerned only with the effect of scattering in the lower portion of the atmosphere (the troposphere), it was necessary to exclude the possible scattering effect on the inhomogeneities of the ionosphere.

The measurements were conducted in the following manner: the radiometer antenna was set in the plane of the sun at a certain inclination (for instance 1°), and with the aid of automatic tracking it followed the azimuthal displacements of the sun. As the sun rose above the horizon, its center would traverse along the vertical axis of antenna symmetry. The observed changes in the signal, after proper amplification, were recorded by a type MPO-2 loop oscillograph and EPP-09 self-recorder. The data were recalculated taking into account the sun's angular displacement. Then the antenna would be shifted to a different angular position and the sun again would pass over its aperture; thus the pattern once again would be recorded for another position of the sun over the horizon. A series of measurements for angular positions of 1, 2.5, 5, and 15° were carried out; a series of patterns for various angular widths were obtained. The measurements were conducted during 3 months in 1954.

The results of this research were in good agreement with the data obtained by G. S. Sauthwroth, H. Booker, and J. Bettencourt (Proc. I. R. E., 1955).

- 48 -

64. <u>Paraboloidal Reflectors of Radio Waves</u>

"The Electromagnetic Field of Electric and Magnetic Dipoles
Located on the Axis of a Paraboloidal Reflector," by P. P.
Biryulin, Tomsk University USSR, <u>Izv. vyssh. uchebn. zavedeniy,
Fizika.</u> 1958, No 1, pp 42-51 (from <u>Referativnyy Zhurnal --
Fizika.</u> No 11, Nov 58, Abstract No 25809)

A boundary problem of electrodynamics is solved for electric and mag-
netic dipoles located on the axis of a paraboloid of revolution parallel
to the axis. The field is found by means of formalism of Green functions
by expanding into series according to proper functions of the problem.
Equations for finding the proper values and series for computing the
proper functions are given.

Instruments

/For information on instruments see Items No 13, 36, and 79./

Components

65. <u>Infrared Microscope</u>

"Infrared Microscope," by P. K. Shchepkov; Moscow, <u>Vestnik
Akademii Nauk SSSR,</u> No 10, Oct 58, pp 64-66

The infrared microscope designed in 1956-1957 at the Electrophysical
Laboratory of the Institute of Metallurgy imeni A. A. Baykov, Academy of
Sciences USSR, is a device capable of examining the interior of nontrans-
parent objects which only slightly absorb infrared rays. This microscope
is capable of magnifying from 100 to 600 times. The source of infrared
radiation can be secured from a helium lamp. The filtered infrared flux
is directed upon the specimen. After passing through the specimen, the
infrared beam impinges upon the objective and is focused from there on
as in an ordinary microscope. The electron-optical converter is mounted
at the focal plane of the microscope in such a manner that the photo-
cathode coincides with the plane. Conversion of the infrared ray image
into an electron stream, so that the electron density is proportional to
the intensity of the transformed image, takes place at the photocathode.
The electron stream is then accelerated by an electric field, passes
through the focusing electrostatic and magnetic lenses, and impinges upon
a fluorescent screen, producing a visible image. The image on the screen
of the converter corresponds precisely to the infrared image; this is
achieved by the high-resolving power of the electron-optical converter.

The described microscope is capable of viewing the inside of opaque materials and, therefore, should find a wide practical application. The infrared microscope permits examination of objects from several microns to several millimeters thick.

66. Electronic Oscilloscope

"Electronic Oscilloscope," by A. Ya. Inkov and I. S. Stekol'-nikov; Moscow, Vestnik Akademii Nauk SSSR, No 10, Oct 58, pp 67-70

At the High-Voltage Gas Discharge Laboratory of the Power Engineering Institute imeni G. M. Krzhizhanovskiy, Academy of Sciences USSR, a portable oscilloscope with time resolving power of $5 \cdot 10^{-10}$ sec/mm, designed for investigation of short-duration high-voltage electrical processes, was developed.

The oscilloscope can register individual voltage pulses of 0.01 to 100 microsec duration having a 10^{-9} sec rise time and amplitude of 100 to 400 v. Horizontal deflection can be adjusted to a time-base of 0.05 -200 microsec of its 130 mm screen. The oscilloscope is synchronized with the examined pulse by means of an external pulse of 50-200 v amplitude of either polarity. The over-all dimensions of the oscilloscope are: length, 580 mm; height, 450 mm; width, 270 mm; and weight, 21.5 kg. Power consumption is about 200 va from a 200 v source. The newly manufactured Soviet high-vacuum, high-voltage cathode-ray tubes have a recording speed of about 100,000 km per sec. The accelerating voltage is 16 kv. The time-base sweep circuit is assembled with GU-50 pentode and a TGZ- 0.1/1.3 thyratron. A high-frequency oscillator built with twin-diode 6N15P, which has five fixed frequencies in a range from 500 kc to 20 Mc, is used to calibrate the time-base sweep.

One to two oscillation periods at 20 Mc frequency can be observed on the oscilloscope screen.

67. Properties of Alloy-Type Germanium Diodes

"Effect of Recombination at a Nonrectifying Electrode on Properties of Germanium Diodes," by N. A. Penin and K. V. Cherkas; Moscow, Radiotekhnika i Elektronika, No 12, Dec 58, pp 1495-1500

The results of experimental investigation of the effect of a second electrode on the basic characteristics of diodes with various base thickness are presented in this article. Two types of nonrectifying electrodes were examined: one prepared by fusion of tin-antimony alloy into the germanium and the other by spraying, in vacuum, copper on the surface of

polished germanium. Alloy-type germanium-indium diodes of various base thickness and rectifying contact diameter (approximately equal to the diffusion length of minority carriers) were examined. The thickness of the base was so selected that the ratio of it to the diffusion length was from 2 to 0.1. One of the basic parameters of volt-ampere characteristics of the diode is its saturation current which, in case of sufficiently thick crystal, is determined by the life of minority carriers in the semiconductor and the speed of recombination of carriers at the free surface near the rectifying contact.

Experimental investigation has revealed that for small base thickness the properties of an n-p junction depend greatly on the speed of recombination of the unbalanced current carrier at the nonrectifying electrode. It was also shown that with decrease of base thickness, frequency change had little effect on the capacitance or resistance of the diode, or on the recombination speed at the nonrectifying electrode. The value of effective speed of recombination for the two types of contacts was as follows: for the tin electrode 600-800 cm/sec, and for copper electrode 5.10^3 to 10^4 cm/sec.

The author thanks S. G. Kalashnikov and A. N. Kovaleva for assistance.

68. East Germans Build 36-Meter Radio Telescope

"Europe's Second-Largest Radio Telescope" (unsigned article); Budapest Muszaki Elet, 16 Oct 58, Vol 13, No 21, p 5

In the German Democratic Republic, Europe's second-largest radio telescope was recently put into operation in the Heinrich Hertz Institute, German Academy of Sciences, as a contribution to the International Geophysical Year. The diameter of the parabolic reflector is 36 meters. The apparatus will serve to do research on radio waves of cosmic origin.

Materials

69. Heat-Resistant Semiconductor Films for Electric Heating Elements

"Brief News Items -- USSR" (unsigned article); Moscow, Atomnaya Energiya, Vol 5, No 5, Nov 58, p 594

At the State Optical Institute a method has been developed for the production of heat-resistant semiconductor films of tin dioxide deposited on ceramic material or fused quartz. As distinguished from the films used hitherto, which are stable only up to 300-350° C, the heat-resistant films retain their electrical characteristics unchanged up to temperatures of

800 -850° C. The high heat resistance of the films is achieved by intro-
ducing antimony as an impurity and subsequently subjecting the films to a
high-temperature treatment. The heat-resistant semiconductor films can be
used to advantage as heating elements in laboratories and in industry.

70. Photoelectronic Emission

"The Connection Between the Photoeffect and the Melting Tempera-
ture and Structure of the Space Lattice of a Metal," by P. A.
Kestner, Tr. Leningr. tekstiln. in-ta, 1958, No 7, pp 166-170
(from Referativnyy Zhurnal, Fizika, No 11, Nov 58, Abstract
No 25635)

By comparing known experimental data, the writer establishes a ratio
between the wave length corresponding to the red photoeffect limit and the
melting temperature of metals. The relationship has the form $\lambda_o \sqrt{T_{mp}}$ = con-
stant. In addition, for metals of the first group with a centered element-
ary cell the value of the ratio λ_{max}/a, (λ_{max} is the wave length cor-
responding to the maximum of photoeffect, and a the length of the edge of
the elementary cell) is also approximately constant and equal to about 800.

/For additional information on materials see Item No 106./

IV. MATHEMATICS

71. Differential Equations of Infinite Order

"Concerning Equations of Infinite Order With Polynomial Coefficients," by Yu. F. Korobeynik, Rostov State University; Moscow, Doklady Akademii Nauk SSSR, Vol 122, No 3, Sep 58, pp 339-342

Until recently a differential equation of infinite order with constant coefficients

$$a_0 y + a_1 y' + a_2 y'' + \ldots = f(x) \tag{1}$$

was considered under the assumption that the characteristic function

$$a_0 + a_1 x + a_2 x^2 + \ldots$$

be analytic in a certain circle having its center at the origin of coordinates. In the work of V. I. Protasov, appearing in DAN, Vol 111, No 6, 1956, we have the first case of equations with rapidly rising coefficients being considered when the characteristic function did not exist.

The equation

$$P_0 (x) y + P_1 (x) y' + P_2 (x) y'' + \ldots = f(x) \tag{2}$$

having polynomial coefficients, has been investigated by A. F. Leont'yev (Tr. Gor'kovsk. ped. inst., 3, 1951) M. G. Khaplanov (DAN, Vol 105, No 6, 1955), and A. A. Mirolyubov (Matem. Sborn., Vol 42 (84), No 1, 65, 1957) under the following assumptions: (a) that the degrees of the polynomials $P_i = \sum_{k=0}^{p_i} a_i^k x^k$ are bounded by one and the same number $p_i \leqslant p$; and that (b) the characteristic functions $w_k = \sum_{i=0}^{\infty} a_i^k x^i$, $k = 0, 1, \ldots, p$ are analytic in a certain circle with its center at the origin of coordinates.

In the present work, the existence and uniqueness (in the defined class of analytic functions) of the solution of equation (2) is established without these assumptions. In addition, a method is given for the approximate solution of equation (2) and a bound is given for the error involved when the method is employed. The method of proof is based on the theory of infinite systems of linear algebraic equations, (F. Riesz, Les systèmes d'equations lineaires a une infinite d'inconnues, 1913).

72. Session on Numerical Analysis

"Scientific Session Within the Mathematics-Mechanics Faculty of Leningrad University," by M. K. Gavurin; Kazan', Izvestiya Vysshikh Uchebnykh Zavedeniy Mathematika, No 5 (6), Sep/Oct, 58, pp 3-4

Annual Scientific Sessions have been conducted at the Leningrad State University for a number of years. Beginning with the 1956-1957 scientific year, thematic scientific sessions have been conducted within the mathematics-mechanics faculty and have been an attraction for scientists of other cities. Such a limited session has proved extremely successful and, with the great interest of the mathematical society of the city, has attained a high scientific level.

The theme of the 1956-1957 session was mathematical physics. The session of 1957-1958 was a jubilee, dedicated to the 40th anniversary of the October Revolution. The theme of this session was numerical analysis. The session was formed by the Scientific Research Institute of Mathematics and Mechanics of the Leningrad State University (Prof S. V. Vallander, director), and the Chair of Computer Mathematics (Prof L. V. Kantorovich, head). In addition to the scientists of Leningrad, there were mathematicians of Moscow and Tartu participating.

The program of the session was as follows:

25 November

    1. A. N. Baluyev, G. G. Men'shikov, and D. A. Roytman, the "Ural" Computer.

    2. M. R. Shura-Bura (Moscow), On Methods of Increasing the Actual Productivity of Mathematical Machines.

    3. O. S. Kulagina (Moscow), Machine Translation From the French

27 November

    1. A. A. Lyapunov (Moscow), Mathematical Problems of Cybernetics.

    2. V. A. Bulavskiy, On Program Automation.

    3. L. T. Peyrova, Performance of Analytic Operations on Machines Having Program Control.

29 November

    1. D. K. Faddeyev, V. N. Faddeyeva, Concerning Several Calculating Methods of Linear Algebra.

2. S. G. Mikhlin, Survey of the Variation Methods for Solving Boundary Value Problems.

3. B. A. Samokish, The Method of Quickest Descent in the Problem Concerning Proper Elements.

3 December

1. L. V. Kantorovich, Problems of Calculation Arising in Problems of Planned Economics.

2. M. V. Keldysh, I. M. Gel'fand, and O. V. Lokutsiyevskiy (Moscow), Difference Methods for Solution of a Cauchy Problem and a Boundary Value Problem.

4 December

1. Yu. Ya. Kaazik, and E. E. Tamme (Tartu), Concerning the Convergence of Iteration Methods for the Solution of Nonlinear Functional Equations.

2. G. G. Men'shikov, A Storage Unit for Constants.

6 December

1. S. M. Lozinskiy, Estimation of the Error of Numerical Integration of Ordinary Differential Equations.

2. I. M. Gel'fand, A. S. Frolov, and N. N. Chentsov (Moscow), Calculation of Multiple Integrals by the Monte Carlo Method.

3. M. K. Gavurin, Methods of Solving Nonlinear Functional Equations.

A number of the works mentioned above were printed in the source of this abstract.

73. Distribution of Singular Points Studied

"Concerning the Distribution of Singular Points of Functions Representable by a Series of Dirichlet Polynomials," by A. I. Kovshov; Moscow, Matematicheskiy Sbornik, Vol 45 (87), No 4, 1958, pp 489-510

Let

$$f(z) = \sum_{n=0}^{\infty} a_n z^n \, ,$$

$$\varphi(z) = \sum_{n=0}^{\infty} b_n z^n, \quad \text{and}$$

$$\Phi(z) = \sum_{n=0}^{\infty} a_n b_n z^n,$$

where the function $\varphi(z)$ has the unique singular point $z = 1$ in the extended plane. In this case, in agreement with the theorem of Adamar (Ye. Titchmarsh, _Teoriya Funktsiy_, (_Theory of Functions_) Moscow-Leningrad, Gostekhizdat, 1951), concerning the multiplication of singularities of analytic functions, the function $\Phi(z)$ is analytic, at least, in the Mittag-Leffer star of the function $f(z)$.

In the present work a theorem is proved in which it is established that the singular points of the function $f(z)$ appearing in the upper Mittag-Keffer star for $f(z)$ within a neighborhood of the point α, under the condition that the function $\Phi(z)$ is regular at the point α, generate an arc of a certain curve of which the point α is an interior point.

For proof of the theorem, the result of Myggli, "Differential Equations of Infinitely High Order With Constant Coefficients" (_Comment. Math. Helv._, 11, 1938, pp 151-179), concerning the existence of a particular solution of the nonhomogeneous linear differential equation of infinite order with constant coefficients was utilized, as well as the result of G. Polya ("A Generalization of the Fabry Gap Law," _Nachr. Gesellsch. Wissensch._, Gottingen, 1927, pp 187-195), concerning the curvature of the regular region of a solution of a homogeneous differential equation of infinite order having constant coefficients.

In the course of the proof of the theorem, a stronger theorem was established concerning the character of distribution of the singular points of the function $f_1(t)$ in a neighborhood of the point α', not being a singular point for the function $w(t) = \sum_{k=0}^{\infty} c_k f_1^{(k)}(t)$, if the integral function $\psi(z) = \sum_{n=0}^{\infty} c_n z^n$ belongs to the class $[1, 0]$.

74. Saturation Classes of Summation Processes

"Saturation Classes for Certain Summation Processes," by F. I. Kharshiladze, Tbilisi Mathematics Institute imeni A. M. Razmadze, Academy of Sciences Georgian SSR; Moscow, _Doklady Akademii Nauk SSSR_, Vol 122, No 3, Sep 58, pp 352-355

Let E be a Banach Space which has a closed system of elements $\{f_k\}$ (k=1, 2,...), and which has a complete sequence of functionals $\{\ell_k(f)\}$ (k= 1, 2,...), generating a biorthogonal system, i.e.,

$$\ell_k(f_1) = \begin{cases} 0 & \text{if } i \neq k, \\ 1 & \text{if } i = k. \end{cases}$$

Each element $f \in E$ may be placed in correspondence with an expansion $\sum_{k=1}^{\infty} \gamma_k (f) f_k$, that is,

$$f \sim \sum_{k=1}^{\infty} \gamma_k (f) f_k. \tag{1}$$

In case of convergence of this series, its sum will be f. The process of summation (Δ) of the series (1), which consists of forming the means

$$u_n^\lambda (f) = \sum_{k=1}^{\infty} \lambda_k^{(n)} \gamma_k (f) f_k , \tag{2}$$

where the multipliers $\lambda_k^{(n)}$ (n= 1, 2,..., k= 1, 2,...) are given numbers (the continuous parameter h may be used as an upper index), is called saturated if the means (2) do not approach f too fast. More exactly, there exists a monotonic positive function $\varphi (n)$ approaching zero and a number m such that the relation $\| f - u_n^\lambda (f) \| = 0 \lfloor \varphi(n) \rfloor$ is satisfied only for elements of the form $f = a_1 f_1 + a_2 f_2 + \ldots + a_m f_m$, where $a_1, a_2, \ldots,$ a_m are numbers.

If in this case there exists an element f, not linearly expressable in terms of $f_1, f_2, \ldots, f_m$ and for which the relation

$$\left\| f - u_n^\lambda (f) \right\| = 0 / \varphi (n) \tag{3}$$

is true, then the saturation of the process (Δ) has order $\varphi (n)$. The linear set of elements satisfying the relation (3) is called the class of saturation of the process (Δ).

The problem of saturation for the process (Δ) consists of finding the class of saturation of that process. To find the class of saturation means to find the structural properties of the functions satisfying relation (3).

Presentation of the problem in this form is due to J. Favard, who introduced it in Analyse Harmonique, Coll. Internat. du Centre Nat. Rech. Sci., Paris, No 15, 97 (1947). Solution of this problem for several processes of summation was given by M. Zamansky, (Ann. Sci. Ecole norm. sup., Vol 66, 3, 19 (1949). P. L. Butzer determined the classes of Saturation of several processes with the help of semigroups, (C. R., Vol 243, 20, 1473 (1956).

In the present work several classes of saturation are found by the elementary method which was mentioned by J. Favard, (J. Math. Pures et Appl., Vol 36, 4, 359 (1957).

V. MEDICINE

Aviation Medicine

75. Altitude Effects on Man at 20,000 Meters and Their Control

"A Human Being at High Altitudes," by Candidate of
Medical Sciences A. Nikolayeu; Moscow, Sovetskaya
Aviatsiya, 4 Nov 58, p 3

This article is a reply to a question sent in by Lt Yu. Sinyakov
who asked: "What changes take place in the organism of man who finds
himself without an altitude compensating suit at an altitude of 20
kilometers?

"It is possible for a human being to fly through the stratosphere,
in a modern plane equipped with a hermetic cabin, for a long period of
time without losing his efficiency. However, in case of sudden deher-
metization of the plane's cabin at high altitude (which is highly
improbable), pressure in the cabin drops rapidly and its occupant
becomes subject to the action of factors encountered at high altitudes.
These factors are: a drop in barometric pressure, a sharp decrease in
partial pressure of oxygen, etc. If the flyer happens to be wearing
an altitude compensating suit, he will suffer no ill effects when exposed
to such factors.

"Symptoms of decompression sickness may appear in an unprotected
man at an altitude of 8,000 meters. These symptoms occur in the form
of pain sensations in the joints and soft tissues. This happens because
of the disruption of the equilibrium betwee   ie amount of air in the
man's body and the amount of air in his imm....ate environment which takes
place as a result of the drop in barometric pressure. When this happens
excess nitrogen is evolved in the organism in the form of bubbles, and
sometimes causes gas plugs in vessels.

"Inspiration of pure oxygen or a mixture of oxygen and another inert
gas will considerably reduce the possibility of such a disturbance.

"If a man who does not have on an altitude compensating suit happens
to be at an altitude of 20 kilometers or higher, his blood will boil in
his unprotected body. Such a condition is described in detail in the
American magazine Journal of Aviation Medicine.

"It is known that boiling occurs when the vapor tension is equal to the pressure exerted on a liquid. The vapor pressure in turn depends on the temperature. To bring any liquid to the boiling point on earth, it must be heated to the point where the vapor pressure becomes greater than that of the atmosphere.

"There is another well-known way of causing a liquid to boil, i. e., to reduce the barometric pressure to a point equal to or below the vapor tension of a liquid at a given temperature.

"It has been established that the boiling point of blood plasma and of tissue liquids in humans and in higher animals is very close to the boiling point of water. On the basis of this it is possible to assume that when the body temperature reaches 37° C at an altitude of 19,187 meters, where the atmospheric pressure is equal to 47 millimeters of mercury, the blood will begin to boil and this will be accompanied by intensive vapor formation. Boiling and vapor formation do not take place in the large arteries even under vacuum conditions because blood pressure in those arteries is always above 47 millimeters of mercury. The venous blood, the pressure of which is considerably lower, will boil when barometric pressure drops to 35-40 millimeters of mercury.

"We know that specially designed space suits are used for flights to high altitudes. If anything should happen to the hermetic cabin, counterpressure is formed in those space suits; this can be depended on to protect the body surface, preventing the development of boiling and vapor formation. However, the space suit does not cover the entire body surface and subcutaneous swelling may take place on the hands which are not protected. According to the foreign press, all the visible manifestations of altitude swelling disappear almost completely after descent to 15,000-16,000 meters. Special gloves which create mechanical pressure on the surface of the hands are now being used to protect him.

Physiology

76. Light Vision Training Studied

"Steady Increase in the Absolute Sensitivity of Vision," by L. A. Shvarts, Institute of Psychology, Academy of Pedagogical Sciences; Moscow, Voprosy Psikhologii, No 5, Sep-Oct 58, pp 56-62

Results of experiments involving recognition revealed that a steady increase takes place in the absolute sensitivity of vision to objects of the same size as those used for training purposes. It was also discovered that increase in the absolute sensitivity of vision is dependent on improvement in recognition of the form of object.

- 59 -

Training in recognition of objects of various form and size was conducted under the conditions of progressively decreased illumination. New conditioned connections formed as a result included a visual response to the initial presentation of the stimulus which affected the absolute sensitivity level. The intensity of visual stimulation, which prior to training produced only an impression of a light spot, now made possible recognition of the form of a light spot which became noticeable under conditions of visual stimulation of lesser intensity.

77. **Changes in Conditioned Reflex Activity During Appearance and Growth of Induced Tumors**

"Concerning the Condition of the Higher Branches of the Central Nervous System in Rats During the Process of the Appearance and Growth of Induced Tumors," by I. P. Tereshchenko. Laboratory of Experimental Pathology (head, Prof S. I. Lebedinskaya), Division of General Pathology (head, Academician A. D. Speranskiy), Institute of Normal and Pathological Physiology (director, Prof V. N. Chernigovskiy); Moscow, Voprosy Onkologii, Vol 4, Jul/Aug 58, pp 418-425

The present research was concentrated on the study of the condition of the higher branches of the nervous system during the process of the appearance and growth of induced tumors. Conditioned reflex activity of white rats served as the criterion for the condition of the higher branches of the nervous system. Tumors were induced by various carcinogenic substances, and appeared in 3.5-6.5 months in 9 of the 12 rats studied.

The author concludes, from his results, that tumor formation is preceded by changes in conditioned reflex activity, and tumor growth is accompanied by profound changes in conditioned reflex activity which in these experiments were characterized by the weakening of the excitation process of the nervous system.

78. **Relationship Between Depolymerization of Nucleic Acids and Rate of Tissue Respiration**

"Concerning the Question of the Mechanism of the Participation of Nucleic Acids in Tissue Respiration," by O. P. Chepinoga, Institute of Biochemistry, Academy of Sciences Ukrainian SSR; Kiev, Ukrainskiy Biokhimicheskiy Zhurnal, Vol 30, No 4, (Oct-Dec) 1958, pp 585-596

The aim of this research was to study the effect of nucleic acids on respiration in hepatic and renal tissues of rabbits.

Rate of respiration was determined according to Warburg's method, and the sodium salt of desoxyribonucleic acid (DNA) was used.

Tables present the effect of DNA on oxygen requirement of renal tissue kept at 37ºC, the effect of phosphate on the rate of respiration of renal tissue in the presence of DNA, the effect of depolymerization of DNA on oxygen requirements of renal tissue, and the effect of DNA on the content of certain phosphate fractions in renal tissue etc.

Results indicate that the effect of DNA on tissue respiration is linked with the condition of DNA polymerization, i. e., high polymers retard tissue respiration, while depolymerized products activate it. Commensurate with the depolymerization of DNA by polymerase (present in the tissue, or introduced from external sources) the depressed respiration rate becomes accelerated. Simultaneous with a rise in oxygen requirement in the presence of depolymerized DNA, inorganic phosphates become esterified.

Thus, depolymerization products of DNA accelerate tissue respiration and participate in the process of oxidative phosphorylation.

79. <u>Wireless Transmitter for Short-Range Biomeasurements</u>

"Miniature Transmitter for Wireless Transmission of Biological Measurement Data From a Freely Moving Human or Animal," by A. H. Frucht and K. Otto; Berlin, <u>Das Deutsche Gesundheitswesen</u>, Vol 13, No 43/44, 23/30 Oct 58, pp 1416-1422

This article reports on a transistorized subminiature transmitter (weight 610 grams; over-all dimensions 4.4 x 9 x 14 cm), produced by the Institute for Applied Physiology of the East German Academy of Social Hygiene, Labor Hygiene, and the Advanced Training of Physicians, Berlin-Lichtenberg. The transmitter has an effective range of about 110 meters. For the transmission of electrocardiographic data, the device makes use of two special electrodes attached to the sternum. The action voltage of the transmitter is fed through the pick-up electrodes to a preamplifier and then to a ring modulator where, after being amplitude-modulated, it is superposed on an intermediate carrier of several kilocycles, which is taken from an auxiliary oscillator. This converts, the very low—frequency action voltage into a frequency range which can be amplified readily. After a repeated amplification in an audiofrequency amplifier designed for the intermediate carrier, the modulated auxiliary carrier is fed to the transmitter where it is frequency-modulated and transmitted.

- 61 -

The preamplifier consists of two transistorized push-pull stages, the first of which operates in a collector circuit and the second in a feedback emitter circuit. This arrangement made it possible to bring the input impedance up to 300 kilohms within the range $0.3-200^{+}$ cps while retaining sufficient amplification to modulate the 2-kc auxiliary carrier by means of the action voltage in the ring modulator consisting of germanium diodes. The auxiliary carrier is likewise generated by means of a transistor. After amplitude-modulation, the modulated intermediate carrier is amplified, in two standard temperature-compensated emitter stages, to the point where the produced voltage is sufficient for a frequency-modulation of the carrier wave. The oscillator for the transmitter operates on the fundamental frequency of 8.75 Mc. Since post office regulations permit a frequency of only 35 Mc for testing, the 4th harmonic has to be filtered out and then transmitted. The use of harmonics in place of the fundamental wave leads to considerable losses of available transmission energy, which can be compensated to a certain degree through the use of a very sensitive receiver.

Radiology

80. Radioactive Arsenic Level in Spinal Fluid and Spinal Cord

"Penetration of Radioactive Arsenic (As^{76}) Into the Spinal Fluid and the Spinal Cord of Animals," by S. A. Yeremenko, Nauchn, Rabot, Belorussk., N-I. Kozhno-Venerol. In-t. (Scientific Works of Belorussian Scientific Research Dermo-Venerological Institutes), 1957, No 5, 79-87 from Referativnyy Zhurnal -- Khimiya, Biologicheskaya Khimiya, No 21, 10 Nov 58, Abstract No 28416, by I. El'man)

CPYRGHT

"In experiments on dogs it was shown that As^{76} can be detected in the spinal fluid of mature animals 10 minutes after its introduction into the organism (still sooner in puppies, within 5-9 minutes). In 15 minutes, As^{76} may also be detected in the spinal cord. Greatest concentration of arsenic is found in the hypophysis. Arsenic introduced intravenously is detected in the spinal fluid sooner than when introduced subcutaneously or intraperitoneally. In puppies a decrease in the arsenic level can be detected in the spinal fluid within 30-45 minutes; in mature dogs, it is detected later."

- 62 -

81. Isotope Applications at Chinese Academy of Medical Sciences

"Accomplishments in the Use of Radioactive Isotopes
by the Chinese Academy of Medical Sciences During the
Past 2 Years," by the Radioactive Isotopes Committee
of Chinese Academy of Medical Sciences; Peiping, K'o-
hsueh T'ung-pao (Scientia), No 21, 1958, pp 659-661

This article summarizes the use of radioactive isotopes in medical
research, diagnosis, and treatment at the Chinese Academy of Medical
Sciences since that academy began using isotopes "almost 2 years ago."
The "accomplishments" reported include the following.

In radiobiological research, the Chinese Academy of Medical Sciences
has used phosphorus 32, iodine 131, and sulfur 35. Phosphorus 32 was used
to study the effect of iontophoresis on phosphorus metabolism of red
corpuscles in experimental rats. In one experiment, test tubes of blood
drawn from rats 5 and 7 days after general exposure to 1,100 or 800
roentgens of radiation were treated with $Na_2HP^{32}0$ and incubated   at
various temperatures with controls. After 10-160 minutes, it was found
that, with other conditions being equal, the red corpuscles of rats which
had been exposed absorbed less tagged phosphorus than the red corpuscles
of normal rats. Moreover, phosphorus absorption was hampered the first
day after exposure and continued to diminish as radiation sickness pro-
gressed. Phorphorus absorption was in inverse proportion to the measure
of radiation received within the range of 600-1,100 roentgens.

Experimental results indicated that the diminished concentration
of P^{32} in red corpuscles was not related to changes in the chemical
composition of blood plasma and could not be fully explained by a lower
red cell count since a postradiation drop in reticulocyte count also
occurred. Conversely, the reticulocyte count rose and the red corpuscles'
absorption of phorphorus increased when anemia was induced by bleeding
the rats. These findings indicated that postradiation diminution of P^{32}
is probably due to disturbances in the hemopoietic function of bone marrow
and the concomitant increase of aging red corpuscles in the blood stream.

In another experiment, it was found that a half-lethal dose (600 r)
of roentgen rays induced changes in the phosphorus absorption of red
corpuscles in direct proportion to changes in the reticulocyte count.
A final rise in phosphorus absorption occurred in the last stage of the
experiment when the hemopoietic function of the bone marrow returned to
normal and new red corpuscles appeared in the blood stream.

In other controlled experiments, the effect of lethal doses and half-lethal doses of radiation on the permeability of blood vessels was determined by the time it took exposed experimental rats to eliminate plasma protein tagged with iodine 131 and sulfur 35 from their blood streams. It was found that a lethal dose (1,100 r) not only shortened the time tagged plasma protein was retained in the blood stream but also increased the concentration of the isotopic compound in internal organs, such as the liver, intestines, heart, and stomach. These abnormal changes indicate that general exposure to a lethal dose intensifies the permeability of the blood vessels of rats and that this condition may be a direct cause of hemorrhage in acute radiation sickness.

In the field of pharmacology, stibine 124 was the tracer used in the search for an effective antidote for ammonium antimony gluconic acid, which is recommended for Japanese schistosomiasis. In rabbit experiments, sodium dimercaptosuccinic acid (SDS) proved superior to any other antidote for antimony described in the literature. Its use in conjunction with ammonium antimony gluconic acid greatly reduced the concentration of antimony in the liver and blood cells. Within 24 hours, 92 percent of the antimony administered was passed in the urine, as compared with only 24 percent when SDS was not used.

The academy's Department of Experimental Morphology obtained significant results in an investigation of the yolk sphere of chick embryos by using sulfur 35.

Research projects which involve the use of isotopes and are currently in progress include the metabolism of radio iodine under various pathological and pharmacological conditions, and the effect of thyroxin on nitrogen metabolism.

Although natural radium and natural radon therapy have been practiced in China for more than 30 years, the clinical use of other isotopes is something new. During the past year, artificial isotopes were introduced into some of the hospitals of the Chinese Academy of Medical Sciences. Radio phosphorus is used in a dressing for dermovascular tumors. It is administered orally for chronic leukemia and polycythemia vera. It is also used as a diagnostic tool to determine blood volume and to locate lymphosarcomas. Radio iodine, however, is used clinically more than any other isotope.

- 64 -

A "cobalt cannon" was installed in the Tumor Hospital of the academy in March 1958. It is significant that, amidst the clamor for a forward leap in industry, it took the Peiping Medical Apparatus Plant only 30 days to design and manufacture China's first cobalt cannon.

At the Chinese Academy of Medical Sciences there are two classes set up for training radioisotope technicians. One concerns isotope applications in scientific research, and the other, applications in clinical medicine. Outside the academy, over 300 physicians and scientists in experimental medicine receive instruction on isotopes from the academy's teaching personnel.

Since China has begun to produce isotopes, their use at the academy and throughout the country is expected to increase by leaps and bounds.

82. Radioactive Arsenic Distribution in Animals, and Its Elimination

"Distribution of Radioactive Arsenic (As 76) in an Animal Organism (Preliminary Report)," by S. A. Yeremenko, Nauch. Rabot. Belorussk. N-i. Kozhno-Venerol. In-t. (Scientific Works of Belorussian Scientific Research Dermo-Venorological Institutes), 1957, No 5, 38-46; (from Referativnyy Zhurnal -- Khimiya, Biologicheskaya Khimiya, No 21, 10 Nov 58, Abstract No 28415, by I. El'man)

"Arsenic, introduced into animal organisms by various means (intravenously, intraperitoneally, subcutaneously, and intra-arterially) was detected in significant amounts within 15 minutes in the renal medulla, the liver, and urine. Highest arsenic activity in the organism was detected 3 hours after its introduction and was distributed as follows (in %): hypophysis 0.573, renal cortex 0.0259 per gram of raw tissue, large intestines 0.02314, bile 0.045, urine 0.0616 per ml, liver 0.0089, spleen 0.00557, and the walls of large intestines 0.0079. The different branches of the brain, at this same time, contained insignificant amounts of arsenic. After 3 hours, the arsenic concentration decreased rapidly, in almost all organs, and within 9-10 days it was almost undetectable both in the organs and in the excreta. Most of the arsenic (55-60%) was eliminated in the urine during the first few days."

83. Central Nervous System Control Over Absorption and Distribution of Radioactive Phosphorus During Deep and Shallow Anesthesia and Sleep

"The Effect of the Central Nervous System on the Absorption of Radioactive Phosphorus From the Pleural Cavity," by V. R. Faitelberg-Blank, Chair of Animal Physiology, Odessa Agricultural Institute; Kiev, Ukrainskiy Biokhimicheskiy Zhurnal, Vol 30, No 4, (Oct-Dec)1958, pp 539-551

Radioactive phosphorus in the form of $Na_2HP^{32}O_4$ was introduced into the pleural cavity of 33 rabbits, and its absorption and deposition in hepatic and pulmonary tissues during deep and shallow ether anesthesia and electrically induced sleep were studied.

During deep ether anesthesia the absorption of radioactive phosphorus was retarded, but during shallow ether anesthesia it was slightly accelerated. No change was evident in the deposition pattern.

Changes in the absorption rate of radioactive phosphorus were evident only during the onset of shallow sleep, but no change was evident in the deposition pattern in either hepatic or pulmonary tissues.

The author concludes that absorption from the pleural cavity is an active process regulated by the nervous system.

84. Effect of Large Doses of Ionizing Radiation on Vitamin C and Carotene

"The Effect of Ionizing Radiation on Vitamin C and Carotene Contained in Certain Preparations and Food Products," by G. M. Yegiazarov (Moscow); Moscow, Voprosy Pitaniya, Vol 17, No 5, Sep/Oct 58, pp 9-11

The present research studies changes produced in vitamins due to ionizing radiation used in sterilizing food products.

Tables present vitamin C content in sauerkraut, in mg %, before and after its irradiation with 100,000 and 150,000 r; vitamin C content in vitamin pills, in mg percent, before and after irradiation with 200,000 and 300,000 r; carotene content in tomato paste, in mg %, before and after its irradiation with 100,000, 200,000, and 300,000 r from gamma rays of radioactive cobalt.

Results indicate that the vitamin C and carotene contents in the foods studied are practically unaffected by even large doses of gamma rays. The vitamin content of certain products decreases due to natural processes of oxidation.

[For additional information on radiology see Item No 32.]

Miscellaneous

85. Rumania Produces Rejuvenation Injections

"Rejuvenation Injections Manufactured by Rumanian Pharmaceutical Industry" (unsigned article; Budapest, Magyar Nemzet, 2 Dec 58

Forty years ago, Professor Parhon began to experiment with treatment of senescence. It was his contention that senescence was really a disease and could be cured as such. Now, years later, they are successfully using novocain injections "H 3" in his institute. Successful experiments have shown that under the effect of the injections, the worn-out human organism regenerates; the old person regains his memory capacity; and muscle nimbleness, blood circulation, nervous system operation, and hormone supply improve.

Industrial production of the injection has begun under the name "Gerovital H 3."

- 67 -

VI.   METALLURGY

[See Items No 25 and 28.]

VII.   PHYSICS

Nuclear Physics

86.   Thermonuclear Reactions

"Work on Controlled Thermonuclear Reactions in the USSR," by L.
A. Artsimovich; Moscow Atomnaya Energiya, Vol 5, No 5, Nov 58,
pp 501-521

     This report, read at the International Conference on Atoms for Peace
at Geneva in 1958, describes the present theoretical and experimental as-
pects of thermonuclear reactions. The author concludes that at present
special attention should be paid to the possibility of utilization of ionic
cyclotron resonance. Research under way on thermonuclear reactions in the
USSR will be described in a future report of the Ukrainian Physicotechnical
Institute.

87.   Neutron Yield in Inelastic Collisions

"Neutron Yield From Inelastic Collisions Between Nuclei and 14
Mev Neutrons and the Cross Sections of the (n,2n) Reaction," by
P. P. Lebedev, Yu. A. Zysin, Yu. S. Klintsov, and B. D. Stsibor-
skiy; Moscow, Atomnaya Energiya, Vol 5, No 5, Nov 58, pp 522-525

     Measurements were carried out of the number of neutrons η , forming
in one act of inelastic neutron interaction with nuclei of a series of
elements of natural isotopic composition: Fe, Cu, Mo, Cd, Sn, Hg, Pb, Bi,
U. The measurements were carried out by means of determination of the rel-
ative variation of the total neutron flow and the weakening of the primary
neutrons after passage through samples of studied substances. Data on the
cross section σ_{in} of the inelastic interaction of neutrons with nuclei of
the mentioned elements were also obtained in this processing. The found
values of η and σ_{in} together with known cross sections of neutron capture
are used for the computation of the cross sections of the reactions (n,2n)
averaged according to the isotopic content, on nonfissioning nuclei.

- 68 -

88. Reactor Design

"Calculation of the Valves Controlling the Coolant Flowing Through a Nuclear Reactor," by B. V. Florinskiy; Moscow, Atomnaya Energiya, Vol 5, No 5, Nov 58, pp 526-532

In designing valves for controlling the coolant flowing through the loops of the reactor the choice of gates becomes a problem. A new method of plotting the curve of coolant control according to the characteristics of the valve is suggested and a method of construction of the valve gate shape according to the specified control curve. As an example, computation necessary for the construction of the gate shape with or without the coupling rod is carried out.

89. A Reactor as Radiation Source

"A Liquid Loop in a Reactor as a Radiation Source for Radiation Chemistry in Particular," by Yu. S. Ryabukhin and A. Kh. Breger; Moscow, Atomnay Energiya, Vol 5, No 5, Nov 58, pp 533-541

An analysis of problems connected with the utilization of powerful radiations of a nuclear reactor seems imperative for application in science, in particular in processes of radiation chemistry. For this purpose a liquid loop with extraction of gamma radiation from the reactor into a special apparatus for the case when the activated substance forms one isotope without radioactive daughter products is discussed. The theory is developed into formulas and graphs facilitating the computation of the power of the gamma rays produced in the equipment and choice of parameters securing the most convenient operation of the loop.

90. Linear Electron Accelerator

"Linear 6-Mev Electron Accelerator With Constant Phase Velocity of the Wave," by V. P.; Moscow, Atomnaya Energiya, Vol 5, No 5, Nov 58, p 589

"A linear 6-Mev electron accelerator with constant phase velocity of the wave was built at the Physicotechnical Institute of the Academy of Sciences Ukrainian SSR. The work was carried out by the associates of the Institute: P. M. Zeydlits, I. A. Grishayev, V. A. Vishnyakov, and A. Ye. Tolstoy under the guidance of K. D. Sinel'nikov, Active Member of the Academy of Sciences Ukrainian SSR.

"The accelerator has many advantages over a linear accelerator with variable phase velocity of the wave: it facilitates the computation of a diaphragmed waveguide and lowers the requirements for accuracy of computation of the accelerating system. The use of bunching device of the

- 69 -

CPYRGHT

> klystron type permits a considerable improvement of the characteristics of the beam. At the output of the accelerator dense electron bunches are formed of a 6-Mev energy at a pulse period of 2 microseconds. The mean current at a pulse frequency of 50 cycles equals 20 microamperes. The half width of the energy spectrum is about 10%. The use of the bunching device doubles the number of accelerated electrons and considerably prevents their scattering according to energies.
>
> "The accelerating system of the accelerator is a waveguide loaded with metallic disks. The length of the waveguide is 80 cm and its diameter is 84 mm. The accelerating system is assembled from separate cups connected by means of a temperature frame. The operating wavelength of the accelerator is 10.7 cm. To eliminate the radial divergency of the beam along the accelerating system, an axially symmetrical magnetic field is produced of 600 gauss strength, decreasing toward the end of the accelerator.

Experimental tests of the accelerator showed good agreement of experimental and theoretical data. The effect of the current charge on the parameters of the accelerator was tested experimentally. This type of accelerator may be used as a powerful source of gamma radiation, as well as for physical research requiring dense bunches of electrons.

91. Suppression of Betatron Oscillations

"Suppression of Betatron Oscillations in Strong Focusing Electron Synchrotrons," by A. A. Kolomenskiy and A. N. Lebedev; Moscow, Atomnaya Energiya, Vol 5, No 5, Nov 58, pp 554-557

Various methods are tested in order to introduce radiation suppression simultaneously of betatron and synchroton oscillations in strong focusing accelerators. Formulas for computing decrements of suppression are derived. It was noted that the curvature of the orbit in damping magnets should differ from the curvature of basic sectors. It is demonstrated that the sum of decrements of suppression is in all cases the same and does not depend on the type of damping system.

92. Energy of Two-Electron Atoms

"The Correlation Effects in Two-Electron Atoms," by D. A. Kirzhnits; Leningrad, Optika i Spektroskopiya, Vol 5, No 5, Nov 58, pp 485-489

A perturbation theory developed in the article is applied to the computation of the correlation correction in the energy of two electron atoms, i.e., the difference in the exact energy value and the value obtained in the approximation of the self-consistent field. The correction obtained appears to be independent of the nuclear charge Z, and the applicability of the outlined method improves with increasing Z. The results concur well with existing data for $Z \leq 6$.

- 70 -

93. Betatron Design and Operation

Referativnyy Zhurnal, Fizika, No 11, Nov 58, abstracts No 24497-24516 and 24520-24524

Twenty-five abstracts in the source cover articles which appeared originally in Izvestiya Tomskogo Politekhnicheskogo Instituta, Vol 87 (1957). The articles, concerning analysis, design, and operation of a betatron are as follows.

"The Existence of a Closed Electron Beam is a Constant Potential Field of Focusing Forces," by N. M. Goloshchanov, pp 275-279 (Abstract No 24497)

"The Potential Function of Focusing Forces of the Betatron Magnetic Field and Its Practical Application to Tuning of Accelerators," by D. A. Noskov, pp 151-156 (Abstract No 24498)

"Computation of the Radius of the Betatron Equilibrium Orbit," by M. F. Filippov, pp 67-76 (Abstract No 24499)

"The Effect of Radial Phase Heterogeneity on the Configuration of the Magnetic Field of Accelerators," by I. G. Leshchenko, pp 130-136 (Abstract No 24300)

"The Method of Pole Design of the Simplest Betatrons," by K. S. Grishin, pp 95-100 (Abstract No 24501)

"Vacuum Chambers and Vacuum System of 15- to 25-Mev Betatrons, by A. G. Vlasov, pp 301-306 (Abstract No 24502)

"Requirements on Electromagnets of Betatron Equipment and the Principles of Their Construction," by B. B. Gel'perin, pp 57-66 (Abstract No 24503)

"A Simplified Injection System for a Pulse Betatron," by D. A. Noskov, pp 224-230 (Abstract No 24504)

"Simplified Injection Systems and Electron Shifts in a Betatron," by V. M. Razin, pp 193-200 (Abstract No 24505)

"The Problem of Circumvention of the Injector by Electrons in a Betatron During Injection," by N. M. Goloshchapov, pp 273-274 (Abstract No 24506)

"Study of the Process of Electron Capture Into the Betatron Acceleration at Various Forms of the Injection Voltage Pulse," by I. P. Chuchalin, pp 256-267 (Abstract No 24507)

"Some Factors Affecting the Process of Electron Capture Into the Betatron Acceleration," by N. M. Goloshchapov, pp 268-272 (Abstract No 24508)

"Extraction of the Electron Beam From the Betatron Chamber," by L. S. Sokolov, pp 314-321 (Abstract No 24509)

"Extraction of Electrons at 10 Mev From the Betatron by Means of a Magnetic Shunt," by L. S. Sokolov, pp 307-313 (Abstract No 24510)

"Extraction of Electrons at 15 Mev From a Betatron by an Electrostatic Method," by B. A. Kononov, pp 322-328 (Abstract No 24511)

"Taking Radiative Deceleration Into Account in Computing the Deviation of Betatron Accelerated Electrons on the Target," by V. M. Razin, pp 187-192 (Abstract No 24512)

"Computation of the Scattering Magnetic Field in Betatrons," by B. B. Gel'perin, pp 83-86 (Abstract No 24513)

"An Approximate Determination of the Scattering Coefficient of the Magnetic Flux Poles of the Betatron Electromagnet," by M. F. Filippov, pp 77-82 (Abstract No 24514)

"Angular Distribution of the High Energy Component of Scattered 25-Mev Betatron Radiation," by N. A. Tikhonov and B. M. Yakovlev, pp 441-445 (Abstract No 24515)

"Organization of the Laboratory and the Protection of Personnel Operating the Betatron," by G. P. Garganeyev, V. A. Moskalev, and B. M. Yakovlev, pp 13-16 (Abstract No 24516)

"Acceleration of Charged Particles in a Ring Volume Resonator With Magnetic Trajectory Control," by A. A. Vorob'yev and G. V. Krivoshchenkov, pp 358-359 (Abstract No 24520)

"The Radiation Effect on Radial Phase Oscillations in Electron Cyclic High-Energy Accelerators," by A. N. Didenko, pp 372-378 (Abstract No 24521)

"Problem of the Nonlinear Theory of Radial Phase Oscillations," by A. N. Didenko, pp 379-383 (Abstract No 24522)

"The Use of Electrodes as Accelerating Equipment of a Synchrotron," by B. A. Solntsev, pp 338-342 (Abstract No 24523)

"Wired Coaxial Resonators for Synchrotrons," by B. A. Solntsev, pp 333-337 (Abstract No 24524)

97. Self-Extinguishing Counter

"Accuracy of Measurement by Means of a Self-Extinguishing Counter," by A. A. Konstantinov, Tr. Vses, n.-i. in-ta metrol., 1957, No 30 (90), pp 143-148 (from Referativnyy Zhurnal -- Fizika, No 11, Nov 58, Abstract No 24535)

A method of measuring the amount of erratic pulses provoked by various secondary processes in gas discharge is described. It is assumed that the erratic pulses occur immediately after the real ones, after the lapse of dead time. The suggested method, based on the assumption that the amplitude of the erratic discharge is always lower than the basic amplitude, is applicable only at low charges of the counter. A radiotechnical diagram permitting determination of the amount of erratic discharges for several values of voltage of the counter and establishment simultaneously as to the degree to which the inclination of the "plateau" is affected by the erratic discharges is discribed. The suggested method does not fully exclude all erratic pulses: a small amount with an amplitude equaling the real ones is not taken into account.

The second described method of a forced "dead" time fully excludes all erratic counts but here it is necessary to consider a correction for misses. At a full account of erratic pulses in the counter an "inclination" of the plateau occurs affected by the increase of the counting space at increasing voltage. As a result of research it was established that counters with polished cathodes inside (aluminum or copper) have a plateau length 1.5 to 2.5 times longer than usual counters. Counters with polished aluminum cathodes are not excited, are insensitive to visible light, and have much better characteristics. By means of these suggestions it is possible to obtain a counter with a plateau inclination of less than 1%.

95. Photon Counter

"Photon Counter With a Pulse Feed," by A. M. Aleskovskiy and V. S. Andrushkevich, Uch. zap. Saratovsk. un-t, 1957, 56, pp 30-38 (from Referativnyy Zhurnal -- Fizika, No 11, Nov 58, Abstract No 24536)

The photon counter may be used for studying the laws of afterglow drop of a gas discharge, the extinction of separate spectral afterglow intervals, and other problems of this kind. The best for this purpose is a G.-M. counter with a platinum photoathode and hydrogen-filled, operating on a pulse regime. The feeding oscillator emits pulses of 100 cycles frequency and a duration of 50 μsec. The pulse amplitude is controlled within a 0- to 500-volt limit with a front steepness below one μsec. The extinction of the discharge in the counter is realized by means of a multivibrator extinction circuit. The plateau of the counter in the pulse feeding regime is much higher than in a static regime; the background of even very poor counters is reduced to almost zero.

- 73 -

96. D-D Reactions in Deuteron Energy Range 0.20-1.75 Mev

"The Study of D-D Reactions Within the Deuteron Energy Range of 0.20-1.75 Mev," by V. V. Volkov, P. Ye. Vorotnikov, Ye. A. Koltypin, N. I. Sidorov, and G. B. Yan'kov, Yadern. reaktsii na legkikh yadrakh (Nuclear Reactions on Light Nuclei), Moscow, 1957, pp 15-25 (from Referativnyy Zhurnal -- Fizika, No 11, Nov 58, Abstract No 24807)

The angular distribution of protons and neutrons formed in reactions $D(d,p)H^3$ and $D(d,n)He^3$ was measured, as well as the absolute proton output under a 90° angle at various deuteron energies. The deuterons were accelerated by electrostatic generators. For measuring thin solid or gas targets use was made of proportional counters of charged particles and wave counters of neutrons. The measured angular proton distributions at energies up to 0.5 Mev concur well with published data. The comparison of proton and neutron yield at an angle of 90° confirms that the ratio of differential cross sections of both branches of d-d reactions are close to unity and are independent of the energy. The angular neutron distribution is more anisotropic than the angular proton distribution. The different anisotropy and the ratio of total cross sections of both branches remains practically constant within the deuteron energy range of 0.5-1.0 Mev and approximates 1.12. The work was completed in 1954-1955.

97. D-D Reactions in Deuteron Energy Range 100-1,000 Kev

"D-D Reactions Within the Deuteron Energy Range of 100-1,000 kev," by A. S. Ganeyev, A. M. Govorov, G. M. Osetinskiy, A. N. Rakivnenko, I. V. Sizov, and V. S. Siksin, Yadern reaktsii na legkhikh yadrakh (Nuclear Reactions on Light Nuclei), Moscow, 1957, pp 26-47 (from Referativnyy Zhurnal -- Fizika, No 11, Nov 58, Abstract No 24808)

The correlation of total cross sections and angular distributions for two branches of D-D reactions are studied. The deuterons accelerated on an electrostatic generator were fed to a specially constructed gas target. The charged reaction products were recorded by proportional counters. The angular proton distributions and the absolute differential cross sections of the reaction $D(d,p)H^3$ were measured within the energy range of 77-1,070 kev and at angles of 0 to 140° (in the center of mass system). The angular distribution of the $D(d,n)He^3$ reaction was measured by He^3 nuclei. The total neutron yield of this reaction was determined from the activation of a $KMnO_4$ solution in a container in the center of which the gaseous target was located. For determining the ratio of cross sections of both branches of D-D reactions a simultaneous measurement of charged particle yield was carried out. The obtained data show a large

- 74 -

asymmetry of angular distribution of the neutron branch as compared with the angular distribution of the proton branch. By comparing the results of the simultaneous recording of T and He^3 nuclei it is found that the difference in asymmetry increases with increasing deuteron energy. The ratio of differential cross sections at a $90°$ angle is close to unity in the studied energy range. Thus, the difference of total cross sections of both branches is explained principally by the difference in the asymmetry of angular distributions. In the deuteron energy range of 400-1,000 kev the ratio equals approximately 1.2.

98. Measuring Neutron Flux in Reactors

"The Use of a Low Inertia Thermobattery for Measuring Strong Neutron Flux in Nuclear Reactors," by B. G. Dubovskiy and V. Ya. Kitayev, Fiz. i teplotekhn. reaktorov (Physics and Thermodynamics of Reactors), Moscow, 1958, pp 128-135 (from Referativnyy Zhurnal --- Fizika, No 11, Nov 58, Abstract No 24871)

The thermal computation is given and the construction of a low inertia uranium thermobattery intended for measuring a neutron flux in the range of 10^{10} to 10^{13} neutron/cm^2·sec is described. The thermobattery composed of chromel-copel thermocouples with each operating terminal covered by a layer of U_3O_8 (1.8 mg), had a diameter of 40 mm, a length of 100 mm, and a total resistance of 10 ohm. It was established that the millivoltmeter kept its linear readings up to flux of $3 \cdot 10^{13}$ and its response to a flux of 10^{12} was 0.5 mv for a thermocouple. In comparing the readings of the uranium thermobattery with a boron ionization chamber, it was found that the thermobattery is not sensitive to short-duration fluctuations of the neutron flux (the time constant is 2 to 0.7 sec. in flux of 10^{12} to $5 \cdot 10^{13}$, respectively) and records sufficiently accurately power variations for periods over 15-20 sec. It is pointed out that the use of the thermobattery substantially simplifies the power control of the reactor and has good prospects for reactors with high specific neutron flux.

99. New Czechoslovak Reactor Planned

"Economic Information: (unsigned article); Prague, Hospodarske Noviny, 12 Oct 58, p 4

The design for a new reactor has been worked out at the Institute of Nuclear Physics of the Czechoslovak Academy of Sciences (Ustav jaderne fyziky CSAV). The reactor is to have a thermal output of 10,000 kilowatts, which is five times the output of the first Czechoslovak reactor in Rez. By means of a heat exchanger it will produce steam at 255 degrees centigrade under a pressure of 44 atmospheres; it will drive a turbine unit with a 2.5-megawatt generator. A small-scale model of the reactor has been built to test certain design and operational principles; a number of laboratory tests of its important parts are in progress. Possibilities of development and production of the proposed equipment are being studied in Czechoslovak industrial plants.

Optics and Spectroscopy

100. Magnetic Crystals

"Optics of Absorbing Magnetic Crystals. II. Vectors of the Plane Wave Field. Refraction Indices and Optical Axes," by L. M. Tomil'chik and F. I. Fedorov; Leningrad, Optika i Spektroskopiya, Vol 5, No 5, Nov 58, pp 601-605

On the basis of a canonic dyadic representation of a complex nonsymmetrical tensor $\varepsilon'^{-1}\mu$, general invariant expressions are obtained determining the complex refraction coefficients and the polarization of plane uniform monochromatic waves, as well as the direction of optic axes in absorbing magnetic nonactive crystals.

101. Luminous Energy Transfer

"Diffusion Approximation of the Equation of Luminous Energy Transfer," by V. I. Kuznetsov; Leningrad, Optika i Spektroskopiya, Vol 5, No 5, Nov 58, pp 606-611

The solution of the equation of luminous energy transfer is analyzed, for the case when in expanding the brightness into Legendre polynomials only the two first terms are considered. It is shown that in such a case the solution of the equation of transfer is reduced to the solution of an equation of the diffusion type. The distance from the source of luminous energy at which the solution is applicable in media in which $\varphi \gg k_0$ is evaluated. An example of solution of the diffusion equation is given.

102. Measurement of Flame Temperature

"Measurement of Flame Temperatures by the Method of Relative Intensities of Spectral Lines," by A. P. Dronov, A. G. Sviridov, and N. N. Sobolev; Leningrad, Optika i Spektroskopiya, Vol 5, No 5, Nov 58, pp 490-499

The relation of intensities of spectral lines of sodium and lithium to concentration of the element was studied in acetylene-air and hydrogen-oxygen flames. It was established that a number of lines of secondary series of these elements may be observed simultaneously in the radiation of the flames without distortion of their intensity by reabsorption. Relative intensities of five lines of sodium and five lines of lithium were measured and their relative probabilities of transition were determined. Experimental data of transition probabilities concur satisfactorily with the theoretical. The results obtained facilitate application of a flame temperature measurement method based on the measurement of relative intensities of spectral lines.

103. Phosphorescence and Photoconductivity

"Formal Analysis of the Theory of Two-Step Excitation of Phosphorescence and Photoconductivity. II. Relaxation Relations," by N. A. Tolstoy and A. V. Shatilov; Leningrad, Optika i Spektroskopiya, Vol 5, No 5, Nov 58, pp 590-600

Using the formal theory of two-step excitation of phosphorescence and photoconductivity, an analysis is carried out of relaxation relations corresponding to processes of growing or dropping of radiation and of photoconductivity at excitation by rectangular light pulses.

104. Resonance Luminescence

"Resonance Luminescence of Finite Volumes," by A. M. Samson; Leningrad, Optika i Spektroskopiya, Vol 5, No 5, Nov 58, pp 500-510

The equation for the number of excited particles in an arbitrary point of the radiating volume is derived, taking into account the forced emission. The equation makes it possible to take under consideration the optic and the nonoptic excitation of the system and the presence of thermal background. The solution of the equation by the method of successive approximations permits determining the magnitude of various orders of radiation facilitating investigation of problems concerned with luminescence of matter within finite volumes.

Theoretical Physics

105. Form of the Spectrum of Schroedinger's Operators Established

"Concerning the Spectrum of Schroedinger's Operator," by G. M. Zhislin, Gor'kiy State University; Moscow, Doklady Akademii Nauk SSSR, Vol 122, No 3, Sep 58, pp 331-334

The form of the spectrum for the operator

$$H = -\sum_{i=1}^{n} a_i \Lambda_i - 2a_0 \sum_{\substack{i,j=1 \\ i<j}}^{n} (\partial^2/\partial x_i \partial x_i + \partial^2/\partial y_i \partial y_j + \partial^2/\partial z_i \partial z_j) -$$

(1)
$$-\sum_{i=1}^{n} b \; 1/[\text{symbol unclear in original text}] \; +$$

$$+ \sum_{\substack{i,j=1 \\ i<j}}^{n} c_{ij} 1/r_{ij},$$

is established

where $a_i = a_0 - a_i$, a_i, b_i, c_{ij} $(i, j = 1, 2, \ldots, n)$

are arbitrary positive numbers and a_0 is any nonnegative number.

In the case $a_0 = 0$, that is, without taking into account the motion of the nucleus, existence of a sequence of eigenvalues of the operator $\tilde{H}$ under the conditions

$$b_i > \sum_{\substack{j=1 \\ j \neq i}}^{n} c_{ij}, \qquad i = 1, 2, \ldots, n$$

(2)

was proved (G. M. Zhislin, DAN, Vol 117, 931, 1957), where $c_{ij} = c_{ji}$ for j less than i, which is satisfied by atoms with any number of electrons having positive ions.

$\tilde{H}$ is the self-conjugate extension of H, obtained in the same manner as in the work of Zhislin.

Magnetism

106. All-Union Conference on the Physics of Magnetic Materials

Izvestiya Akademii Nauk SSSR, Seriya Fizicheskaya, Vol 22, No 10, Oct 58

The entire issue of the periodical is devoted to materials presented at the All-Union Conference on the Physics of Magnetic Materials, held in Leningrad in December 1957. The following papers are covered.

"Dynamic Constants of Magnetically Polarized Magnetoelastic (Magneto-strictive) and Electrically Polarized (Electrostrictive) Media," by K. B. Vlasov, Institute of Physics of Metals, Academy of Sciences USSR, pp 1159-1167

Equations expressing the dynamic behavior of magnetically polarized magnetoelastic media and of electrically polarized electrostrictive media are derived. The unbalanced processes occurring in these media are taken under consideration by the method of the so-called thermodynamics of irreversible processes.

"Phenomenological Theory of Ferromagnetism and Antiferromagnetism in the Low Temperature Range (Uniaxial Case)," by Ye. A. Turov and Yu. P. Irkhin, Institute of Physics of Metals, Academy of Sciences USSR, pp 1168-1176

"The Magnetic Structure and Processes of Magnetizing Highly Coercive Ferromagnetics," by Ya. S. Shur, Institute of the Physics of Metals, Academy of Sciences USSR, pp 1177-1180

For many years the Institute of the Physics of Metals has conducted studies on the magnetic structure of highly coercive ferromagnetics. The basic results of these studies are outlined. It is concluded from the data presented that the magnetic properties of ferromagnetics regularly vary with their magnetic structure.

"Dynamics of Domain Structure in Crystals of Transformer Steel Under Action of Stress," by L. V. Kirenskiy, M. K. Savchenko, and A. M. Rodichev, pp 1181-1184.

"Variation of Magnetic Structure of Silicon Iron Crystals Under Action of Elastic Stresses," by V. A. Zaykova and Ya. S. Shur, Institute of the Physics of Metals, Academy of Sciences USSR, pp 1185-1189

The purpose of the work is the establishment of general laws of variation of the magnetic structure of ferromagnetic crystals during elastic unidirectional stretching. This kind of variation of magnetic structure was found to be irreversible.

"Magnetic Structure of Remanence of a Ferromagnetic and Its Variation During Demagnetization by an Alternating Field," by I. Ye. Startseva and Ya. S. Shur, Institute of the Physics of Metals, Academy of Sciences USSR, pp 1189-1193

An attempt was made to find the reason for discrepancy between the theoretical and the experimental value of remanence of a ferromagnetic. From observations of power patterns on the surface of separate crystallites of polycrystalline samples, it was concluded that the crystals in state of remanence contain, together with magnetic domains in which the magnetic vector is oriented toward the direction of weak magnetization nearest the orientation of the field responsible for the preliminary magnetization of the sample, also reversed magnetic domains and additional domains of various types, among them subdomains. The abundance of these domains explains an additional lowering of the magnitude of the remanence in comparison with the theoretically computed value.

"Temperature Stabilization of Magnetic Properties of Alloys," by I. M. Puzey, pp 1194-1199

"Magnetic Anisotropy and Hysteresis Losses in Rotating Magnetic Fields in Single Crystal Magnetite at Low Temperatures," by N. P. Narovskaya, Chair of Physics, Moscow Institute of Railway Transport Engineers," pp 1200-1204

"The Nature of the Effect of Thermomagnetic Treatment on Magnetically Soft Ferromagnetics," by A. A. Glazer and Ya. S. Shur, Institute of the Physics of Metals, pp 1205-1211

An attempt was made to find a connection between the effects of thermomagnetic treatment and the processes of progressing order in ferro-magnetics. It was established that distant order does not play an essential role in the mechanism of the thermomagnetic treatment. The state appearing after the thermomagnetic treatment, different from an ordered state as well as from a disordered one and leading to a magnetic unique axis, is a special structural state in the formation of which only a few atoms take part. Because

- 80 -

this state is destroyed during progressing order, when forces of electrostatic origin are acting, we may assume that this specified structure occurs under the action of magnetic forces. Such a structure was predicted theoretically by L. Neel (J. Phys. et Radium, 15, 225, 1954).

"Investigations of Kinetics Establishing the Magnetic Texture in a 65% Permalloy," by Sh. I. Zusman, pp 1212-1216

"Synthesis and Magnetic Properties of Ferrites With a Rectangular Hysteresis Loop," by L. I. Rabkin, S. A. Soskin, and B. Sh. Epshteyn, Scientific Research Institute of Telephone Communications, pp 1217-1224

"Kinetics of Thermomechanical Treatment of Ferromagnetics," by F. N. Dunayev, Chair of Experimental Physics, Ural State University imeni Gor'kiy, pp 1225-1230

"Texture Formation During Annealing of Cold Rolled Transformer Steel," by L. V. Mironov, Ural Scientific Research Institute of Ferrous Metals, pp 1231-1236

"Magnetic Analysis of Texture of Deformation of Cold Rolling and Recrystallization in Pure Electrolytic Nickel," by N. L. Bryukhatov, N. A. Grinchar, and I. Ya. Yekamasov. Chair of Physics, Moscow Institute Railway Transport Engineers, pp 1237-1243

"Magnetostriction of Nickel-Iron-Molybdenum Alloys," by I. M. Puzey and B. V. Molotilov, pp 1244-1250

"Volume Magnetostriction of Iron-Nickel-Molybdenum Alloys," by I. M. Puzey, B. V. Molotilov, and A. I. Rad'kov, Institute of Precision Alloys, Central Scientific Research Institute of Ferrous Metallurgy, pp 1251-1253

"Magnetostrictive Properties of Binary Alloys," by G. P. D'yakov, Physics Faculty, Moscow State University imeni Lomonosov, pp 1254-1258

"The Relation of Response of Magnetostrictive Receivers to Their Magnetic Characteristics," by Ya. S. Shur, M. G. Luzhinskaya, K. B. Vlasov, O. I. Shiryayeva, and V. A. Zaykova, Institute of the Physics of Metals, Academy of Sciences USSR, pp 1259-1262

"Variation of Structural Transformations in Permalloy During Alloying With Molybdenum," by Yu. S. Avraamov, B. G. Livshits, and V. B. Osvenskiy, Laboratory of Metallography, Moscow Institute of Steel imeni Stalin, pp 1263-1268

"The Anisotropy of Coercive Force in Magnetoanisotropic Samples of Fine Powders," by Ye. V. Shtolts, Ya. S. Shur, and G. S. Kandaurova, Institute of the Physics of Metals, Academy of Sciences USSR; Physico-Mathematics Faculty, Ural State University, pp 1269-1272

Measurements of coercive force of magnetic uniaxial powdered materials were carried out on cobalt, Mn-Bi alloy, magnetite, and gamma-ferric oxide. It was found that data on anisotropy of the coercive force in magnetic anisotropic ferromagnetics may give valuable information on their magnetic structure.

"The Problem of Temperature Dependence of Magnetic Properties of Highly Coercive Alloys," by N. A. Baranova and Ya. S. Shur, Institute of the Physics of Metals, Academy of Sciences USSR, pp 1272-1275

Studies were carried out on alloys Alnico (51% Fe, 24% Co, 14% Ni, 8% Al, 3% Cu) and on Vickalloy (35% Fe, 52% Co, 13% V). By means of thermomagnetic treatment varied magnetic texture was created in Alnico. It was found that in Vickalloy the coercive force drops with temperature, which is due to a decrease of saturation magnetism with rising temperature.

"Some Problems of Physics of Magnetodielectrics," by L. I. Rabkin, pp 1276-1281

"Magnetic Properties of Ferrites With a Compensation Point," by K. P. Belov, K. M. Bol'shova, T. A. Yelkina, and M. A. Zaytseva, Physics Faculty, Moscow State University imeni Lomonosov, pp 1282-1292

VIII. MISCELLANEOUS

107. Nonore Mineral Construction Materials and Hydromechanization Institute
Established in Kuybyshevskaya Oblast

"Scientific Research Institute in Zhigulevsk" (unsigned article);
Riga, Sovetskaya Latviya, 9 Oct 58

The first Soviet All-Union Scientific Research Institute of Nonore
Mineral Construction Materials and Hydromechanization (Vsesoyuznyy Nauchno-
Issledovatel'skiy Institut Nerudnykh Stroitel'nykh Materialov i Gidro-
mekhanizatsii [VNIINERUD]) has been establish.... in Zhigulevsk, near Stav-
ropol', Kuybyshevskaya Oblast. The new institute will utilize the
production-technical base of "Kuybyshevgidrostroy" which has in Zhigulevsk
a large stone quarry, stone crusher plants, and sand and gravel enterprises.
The institute's aim is to produce on a rapid basis good quality nonore
mineral construction materials.

108. Affiliate of Academy of Sciences USSR in Southeast RSFSR Is Proposed

"Form an Affiliate of the Academy of Sciences USSR in South-
east RSFSR," by L. Zhdanov, Active Member, All-Union Academy of
Agricultural Sciences imeni V. I. Lenin, and others; Mosocw,
Izvestiya, 12 Oct 58

It has been proposed that an affiliate of the Academy of Sciences
USSR be established in Southeast RSFSR. Its area coverage will include
Rostovskaya, Stalingradskaya, and Astrakhanskaya oblasts, Krasnodarskiy
and Stavropol'skiy krays, and the Kalmytskaya, Kabardino-Balkarskaya,
Severo-Osetinskaya, and Checheno-Ingushskaya ASSR, with headquarters located
in Rostov-na-Donu.

The new affiliate would control the activities of over 40 institutions,
and would be the coordinating scientific research center for that area.

No definite plans have yet been set forth for establishing the affiliate.

109. Recent Doctoral and Candidate Theses in Hungary

"Report From the Scientific Qualifications Committee -- New
Doctors and Candidates, July-September 1958" (unsigned article);
Budapest Magyar Tudomany, Oct 58

The Scientific Qualifications Committee has qualified the following
for the degrees indicated:

Janos Grofcsik, Doctor of Chemical Sciences, on the basis of his dissertation titled: "An Examination of Circumstances Giving Rise to Mullite in Ceramic Materials Containing Aluminum Silicate." His opponents were Academician Aladar Vendl; Bela Lanyi, Doctor of Chemical Sciences; and Istvan Naray-Szabo, Doctor of Chemical Sciences.

Bela Jambor, Doctor of Biological Sciences, on the basis of his dissertation titled: "Tetrazolium Salts in Biology." His opponents were Academician Sandor Muller; Barna Gyorffy, Doctor of Biological Sciences; and Karoly Vass, Doctor of Chemical Sciences.

Zoltan Boszormenyi, Candidate of Medical Sciences, on the basis of his dissertation titled: "Data on Symptomatology and Therapeutic Use of Experimental Psychoses." His opponents were Corresponding Member of the Academy Istvan Kornyey and Gyula Nyiro, Candidate of Medical Sciences.

Endre Koros, Candidate of Chemical Sciences on the basis of his dissertation titled: "Data on the Chemistry and Analytical Chemistry of Polyanionic Compounds of Sulfur and selenium." His opponents were Corresponding Member of the Academy Zoltan Szabo and Pal Szarvas, Candidate of Chemical Sciences.

Bela Locsei, Candidate of Chemical Sciences, on the basis of his dissertation titled: "Silicate Chemistry Fundamentals for the Production of Crystalline Synthetic Stone." His opponents were Bela Lengyel, Doctor of Chemical Sciences and Marta Deri, Candidate of Technical Sciences.

Karoly Sarkadi, Candidate of Mathematical Sciences, on the basis of his dissertation titled: "Examinations in the Problem Area of the Bayes Theorem." His opponents were Karoly Tandori, Doctor of Mathematical Sciences, and Istvan Vincze, Candidate of Mathematical Sciences.

110. Czechoslovak Academician Dies

"Local and Foreign News" (unsigned article); Prague, Obrana Lidu, 4 Nov 58, p 2

Josef Kratochvil, outstanding Czechoslovak minerologist and petrographer, died on 1 November 1958 at the age of 80. Kratochvil has completed more than 100 scientific studies, the most important of which is "Topographic Minerology of Bohemia," which includes a complete list of minerals and their locations.

* * *

USCOMM-DC-55868